NOV 3 1911
PUBLIC LIBRARY, DETROIT.

November 2, 1911

American Machinist

A Practical Journal of Machine Construction

Issued Weekly by the Hill Publishing Company : : : 505 Pearl Street, New York

Price 15 Cents, $4.00 per Year Outline of Topics 217 Advertising Index 67

Here Are Unlimited Manufacturing Facilities At Your Command

We Do Absolutely No Manufacturing Whatever for Our Own Account—

We maintain a large force of capable Tool Designers and Engineers and operate one of the most extensive and completely equipped Tool Making Departments in the world.

We are able to skillfully, efficiently and with promptness handle the development of models and the redesigning of machines for economical manufacture.

Our Tool Making equipment includes 70 milling machines, 35 lathes and a sufficient complement of drill presses, bench lathes, shapers, planers, grinders and miscellaneous devices to handle this class of work in the most satisfactory manner.

In the Manufacturing Departments there are hundreds of milling machines of various sizes, lathes of wide range, hand and automatic screw machines, drill presses of various types, surface and cylindrical grinders, a diverse line of horizontal and vertical boring mills, automatic gear cutters, cam cutters, punch presses, broaching machines and many special devices for handling difficult and accurate work.

This organization and equipment, supplemented by complete and modern heat treating, electro plating and enameling facilities, present advantages worth considering before you decide to build a Plant of your own.

Our Sole Commodity Is Service

THE TAFT-PEIRCE MANUFACTURING COMPANY

WOONSOCKET *Contract Manufacturing, Mechanical Engineers and Designers of Special Tools and Machinery* RHODE ISLAND

Western Office: 1311 Majestic Building, Detroit, Mich. New York Office: 165 Broadway

Economy in Drilling

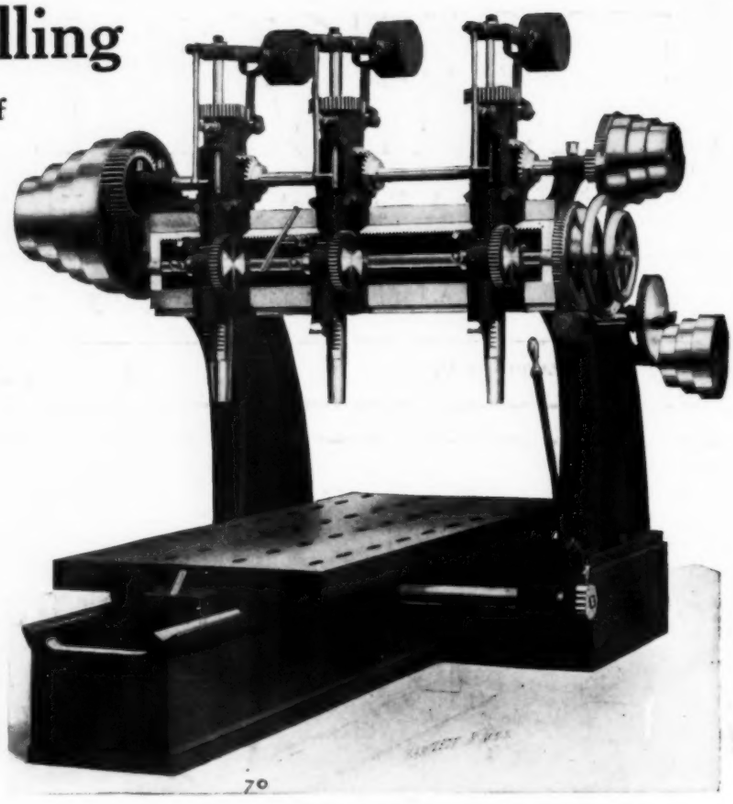
is assured by the installation of

Niles Multiple Spindle Drills

A multiple spindle drill is usually connected in idea with light drilling but it is equally advantageous for heavy duty.

We build Multiple Spindle Drills in every type and size for Light or Heavy Duty.

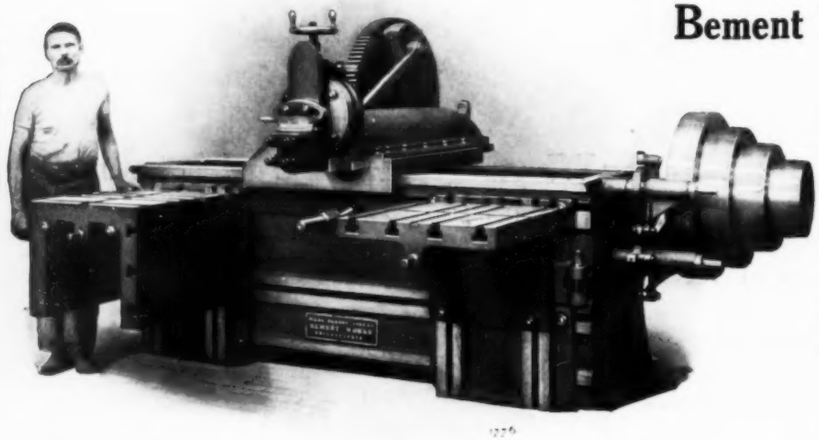
It will be to your benefit to write for descriptive circulars.



Niles 3 Spindle Drill with Traveling Table.

Maximum Accuracy at Heavy Duty

Bement Traveling Head Shaper



20 inch Bement Single Traveling Head Shaper.

A design of Shaper that is unique in that instead of the usual arrangement of the work feeding to the tool, the work is held stationary and the head feeds. The bed is put under no strain—hence accuracy is easily maintained. This machine is built with Single or Double Head traveling over the bed. It is capable of the heaviest duty and will maintain lasting accuracy.

Built in 3 sizes, belt or motor drive.

Write for full descriptive circulars.

Niles-Bement-Pond Company

111 Broadway, New York. 23-25 Victoria St., London, S. W.

SALES OFFICES—Boston: Oliver Bldg. **Philadelphia:** 21st and Callowhill Sts. **Pittsburgh:** Frick Bldg. **Cleveland:** The Niles Tool Works Co., Rockefeller Bldg. **Hamilton, O.:** The Niles Tool Works Co. **Detroit:** Majestic Bldg. **Chicago:** Commercial National Bank Bldg. **St. Louis:** 516 North Third St. **Agents for Gulf States:** LeSourd & Walpole, Birmingham, Ala. **For California, Nevada and Arizona:** Harron, Rickard & McCone, San Francisco and Los Angeles. **For Washington and Idaho:** Hallidie Machry. Co., Seattle and Spokane. **For Oregon:** Portland Machinery Co., Portland. **For Colorado:** Hendrie & Bolthoff Mfg. & Supply Co., Denver. **Agents for Canada:** The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto and Vancouver. **Japan:** F. W. Horne, 70-C Yokohama. **Italy:** Ing. Ercole Vaghi, Milan. **Germany:** F. G. Kretschmer & Co., Frankfort a.M. **Austria-Hungary:** E. Krause & Co., Vienna, Prag and Budapest.

"Soo" Railway Shops in Minneapolis

By F. A. Stanley *

The shops of the Minneapolis, St. Paul & Sault Ste. Marie railway, at Shoreham, Minneapolis, Minn., contain many features of interest to the visiting mechanic, and a number of the special tools and methods there employed are illustrated by the accompanying engravings.

Methods of boring driving boxes, machining links on the vertical slotter, and finishing crosshead pins with a bench fixture.

Pneumatically operated tools for testing feed valves, cutting couplings from air hose and forcing nipples into new hose.

Fuel-oil burners for heating tires, and other useful apparatus in the wheel shop.

*Western editor.

Crosshead Pin Fixture

The fixture in Figs. 1 and 2 is a bench device for turning wristpins in forged-steel crossheads. It is driven by an air motor, the spindle of which is connected with the taper shank on the pinion shaft of the fixture. One of the cutters is shown at *A* and consists of a flat inserted tool in the split gear *B*. The latter is cut down at the center to form a neck which runs in a bearing bored in the split frame *C*. Three bolts hold the cap of this frame to the lower half and upon removing the upper member *C* one-half of the split gear *B* can be removed to allow the crosshead pin to be inclosed by the gear. The crosshead is held on parallels on the base plate of the fixture by a strap and two bolts and after it is located in place for the machining operation, the upper half of the cutter gear and the top of the carrying frame are replaced so that the fixture is ready for starting up.

The split gear carries an inserted cutter at each side and these are secured by countersunk head bolts which when tightened up bind the cutters firmly in place. The cutter is in each case adapted for turning the surface of the pin and forming the fillet at the junction of the pin and crosshead body. As the cutters work from opposite faces of the gear and each turns one-half of the pin, the device is fed crosswise only a little over half the length of the pin to complete the job. Several cuts are necessary to reduce the roughly forged pin to a cylindrical form of the desired diameter and the feeding of the tools into the work for successive cuts is accomplished by releasing the binding screws slightly and simply tapping the ends of the cutters lightly with a hammer. After one end of the pin and the fillet have been finished the turned portion is used as a gage for setting the opposite cutter to machine the other half of the pin.

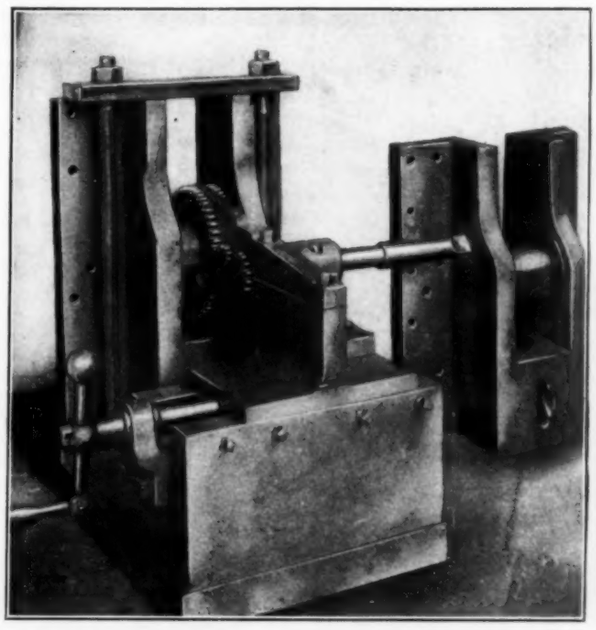


Fig. 1.

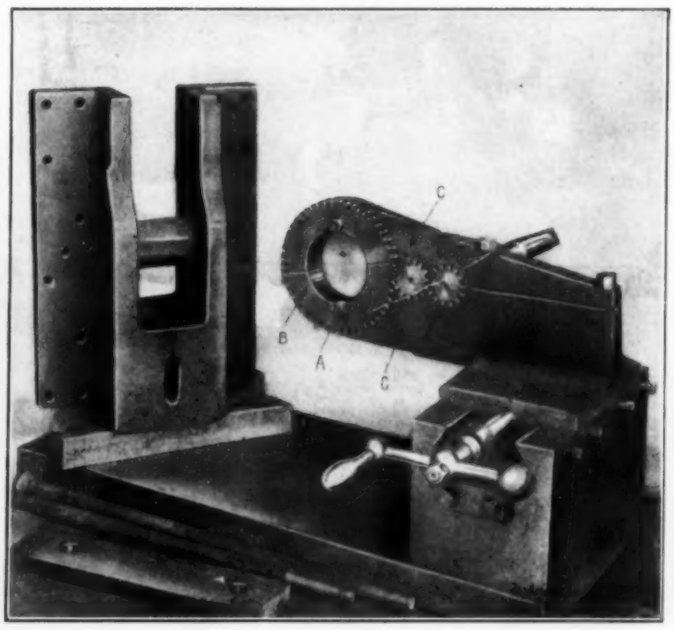


Fig. 2.

Fixture for Machining Crosshead Pins

Boring Driving Boxes

The machine in Fig. 3, a Niles vertical boring mill, is represented as equipped with a homemade fixture for holding driving boxes while the brass is being bored to size.

The bronze shell is first turned off on the outside to the required diameter and then forced into a seat planed in the cast-steel box which is planed parallel on the sides that enter between the jaws of the locomotive frame. The box is placed for boring between the two jaws of the fixture in Fig. 3, where it is located centrally by the edges of the jaws which are closed simultaneously through the medium of a right- and left-hand screw. Here the work rests upon its lower flange and is secured between parallels by setscrews which pass through the jaws as illustrated.

The fixture is located upon the table of the boring mill by a central hub and clamped by straps at the sides. The jaws when set up to the work can be clamped by means of setscrews at the side of the guide which bear against a pair of gibs.

Removing Retaining Collars on Crank Pins

Fig. 4 illustrates the operation of facing off retaining collars which are formed on driving-wheel crank pins. These fixed collars as formerly used on the "Soo" engines are being dispensed with and to turn them off from the pins a cutter bar and cutter are applied as represented. The pair of wheels are blocked on the truck opposite the spindle of the radial

FIG. 3. BORING LOCOMOTIVE DRIVING BOXES

machine and a hole is drilled through the pin endwise, this being followed by the bar with its flat cutters which face off the end of the pin until the collar is completely cut away.

The engraving, Fig. 5, illustrates a convenient method of handling nuts at the tapping machine. The rack with its 18 divisions is built up of angles and boiler plate with a sloping mouth at the front of each compartment, into which the nut blanks are easily dumped, and from the rear of which they are removed for placing in the tapping machine.

A LINK FIXTURE

The fixture in Fig. 6 is for handling links in the slotter. The plate upon which the link is secured when undergoing machining operations, is placed on the slotter table and connected to the table merely by a pin which is free to slide in the crosswise slot in the bottom of the plate. The plate is pivoted at the proper radius by two projecting arms which pass over a stud secured in the adjustable central member of the supporting frame work. The work is fed past the tool by the regular cross feed of the slotter and the pivoted arms cause it to move in a circular path of the required radius. By changing the cutting tool, both the outer and inner surfaces of the link are finished to the desired curve with equal facility.

AIR HOSE TOOLS

For removing nipples and couplings from old air hose, the pneumatic device shown in Fig. 7 is used. The hose is placed in a V-block under the ram and a turn of the air valve causes the piston to descend, showing a pair of splitting knives through the walls of the hose and tearing it from the connection.

The apparatus in Fig. 8 grasps a fresh length of hose between two semi-circular jaws and forces a nipple into the end of the hose. Both pistons for operating the holding jaws and for forcing the nipple home, are air operated.

Another device in the same department is illustrated in Fig. 9. This shows a portion of the apparatus for testing air-feed valves, one of which is seen in place, undergoing a test. Instead of securing the valve for this test by means of bolts, or similar devices, requiring more or less time to apply, a forked-shaped clamp is used which is controlled by a turn of a handwheel and which requires but an instant to secure or release the valve from its seat on the testing apparatus. This clamp is pivoted near the front or forked end, and the handwheel at the rear acts upon a screw threaded through the end of the clamp lever and bearing upon the base of the device. It is obvious that no time is wasted in setting or removing the valve where this clamp is used.

GREASE CUP OPERATIONS

The steel grease cups seen in various stages in Fig. 10 are formed in a heading machine, the chamfer in the large end being punched at the same time the cup is formed. The piece is then finished in a Jones & Lamson flat turret lathe. Sufficient stock is left at the end in the heading operation to allow the work to be chucked properly and after the finishing process the surplus metal is cut off, leaving length enough, however, for a dowel, as the piece serves as both grease cup and dowel.

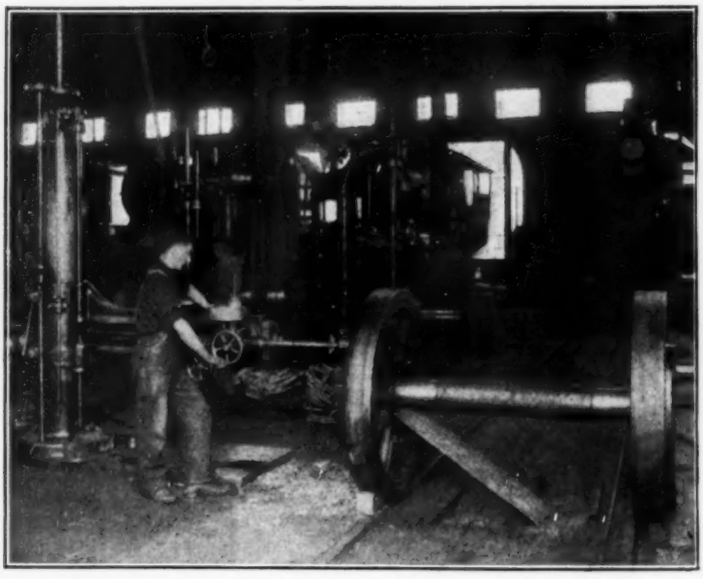


FIG. 4. FACING OFF RETAINING COLLARS ON CRANK PINS

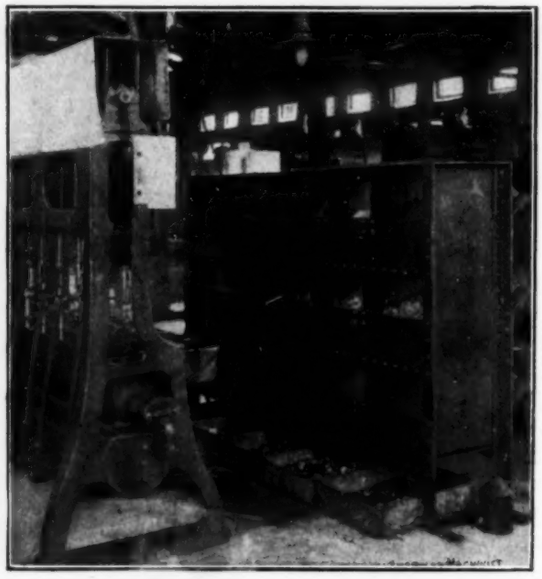


FIG. 5. A CONVENIENT BIN FOR NUTS

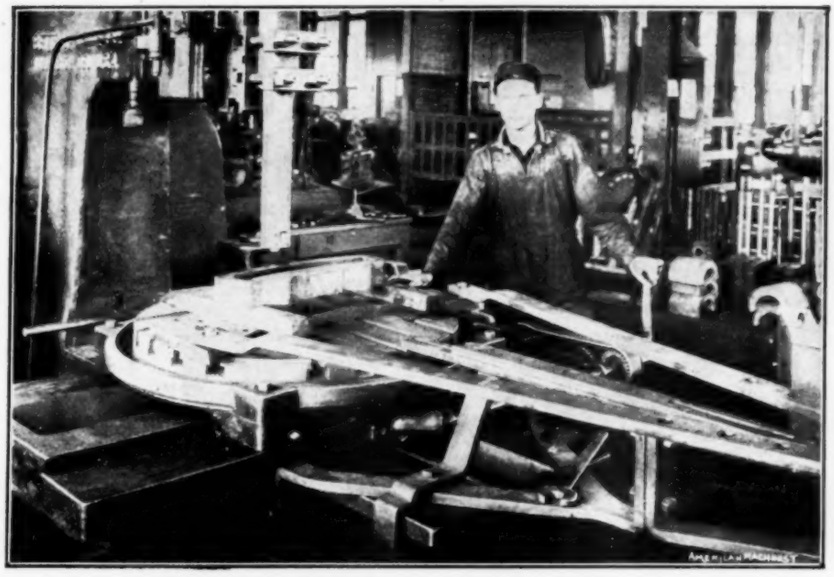


FIG. 6. LINK-MACHINING FIXTURE

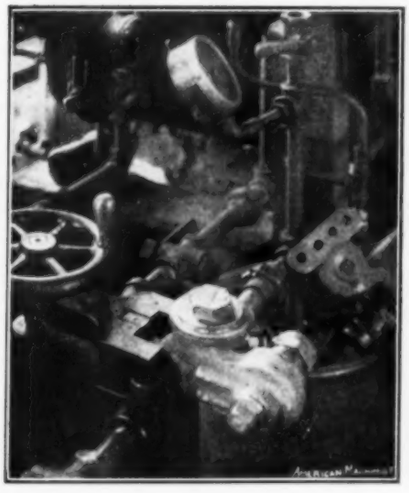


FIG. 9. CLAMP FOR HOLDING AIR-FEED VALVE ON TESTING APPARATUS

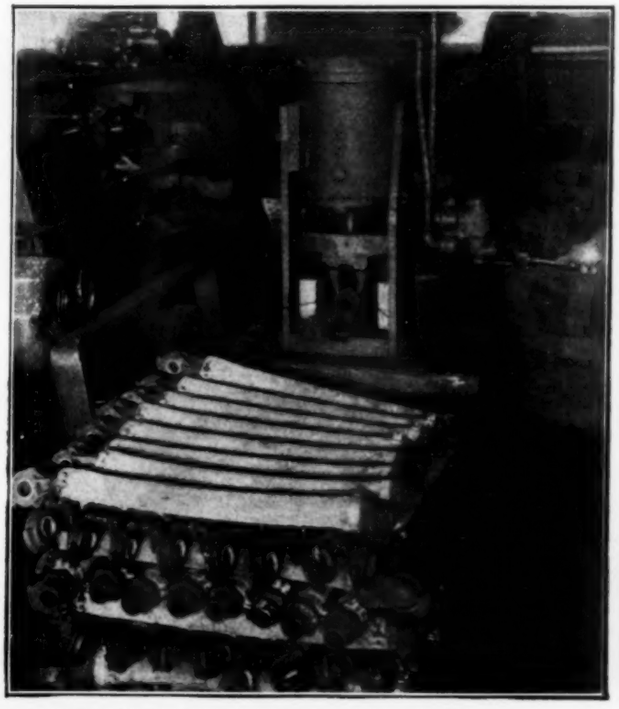


FIG. 7. METHOD OF REMOVING AIR-HOSE CONNECTIONS

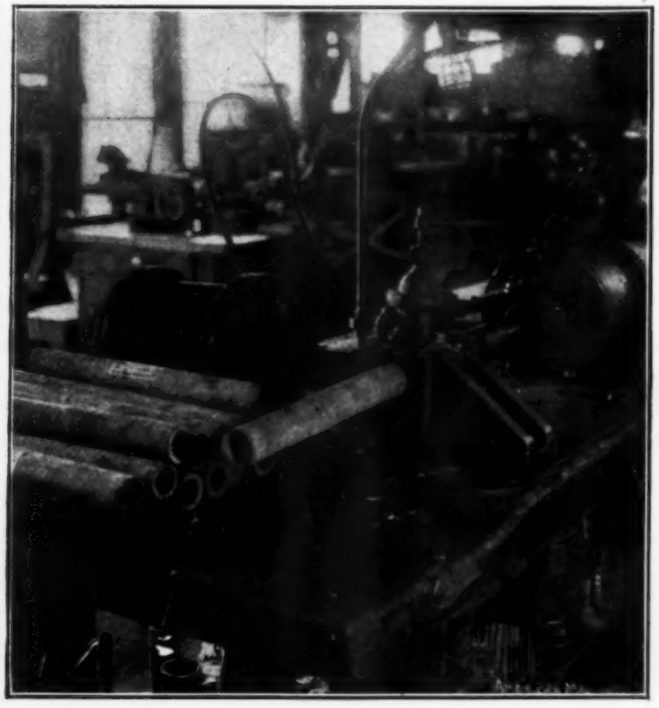


FIG. 8. APPARATUS FOR FORCING CONNECTIONS INTO AIR HOSE

FIG. 11. HOMEMADE SPEED LATHE

FIG. 10. GREASE CUPS

A Homemade Speed Lathe

he speed lathe in Fig. 11 is made of a length of steam pipe for a bed and with pipe fittings for headstock. It is supported on flanged fittings in place of feet. The spindle is driven by a three-step cone and runs in suitable bearings in the built up headstock. It is used constantly for light drilling, filing, etc.

An interesting operation seen in the wheel shop is the heating of truck-wheel and coach-wheel tires, old tires to be removed and new ones for replacing them are heated by oil burners made by the Mahr Fuel Oil Burner Company of Minneapolis. The tire heater is illustrated by Figs. 12 and 13. It uses crude oil and has three burners spaced as shown around the wall of the heater. The wheels coming to the shop with worn out tires are placed in the heater as in Fig. 12, the burners lighted and as soon as the tire expands the wheel drops through on to the truck below. The truck is then pulled out, as in Fig. 13, and a new tire heated and placed on the wheel; or a number of tires can be removed and replaced as desired.

Another interesting form of burner by the same company is shown in Fig. 14 which illustrates the application of a portable burner in straightening up a steel car that has been in a wreck.

A Sling for the Wheel Lathe

The sling in Fig. 15 is used in the wheel shop for lifting axles and wheels into the lathe. The feature of interest is the spring connection which suspends the device from the trolley hook and which facilitates the lifting of work in and out of the lathe, as the workman by observing the action of the flexible connection knows just when the load is partially or fully taken up by the hoist and he can, therefore readily control the operations of setting and removing the work.

Fig. 12.

Tire Heater with Fuel-oil Burner

Fig. 13.

Fig. 14. Use of the Oil Burner

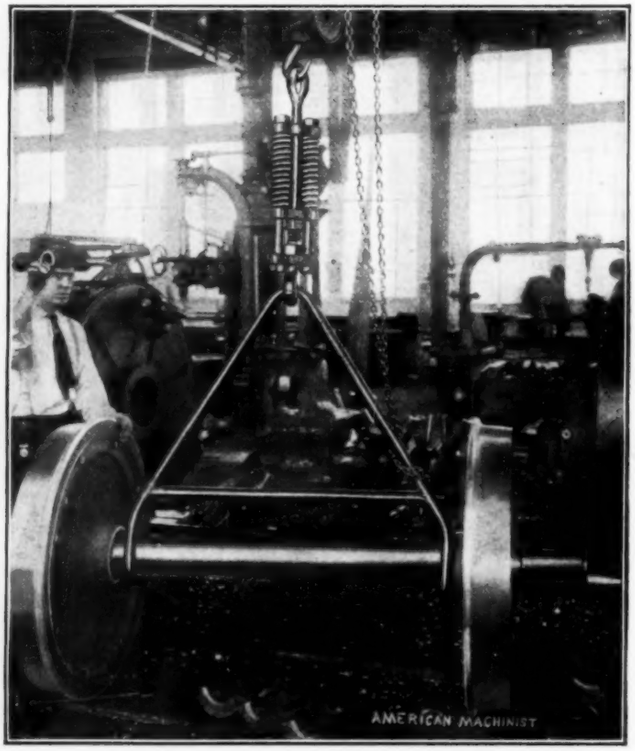


Fig. 15. Sling for Wheel Lathe

Efficiency of Automobile Gears

By Chas. H. Logue

Eleven factors are pointed out that influence gear efficiency, together with an analysis of each common type of gear with reference to its advantages and disadvantages as a means for transmitting power in an automobile.

Just at present there is in progress a discussion relative to the efficiency of automobile gears. No two tests agree. Many of the tables published are evidently too low; one authority gives 60 per cent. as the combined efficiency of three sets of gears and five bearings. Suppose for instance that a 60-horsepower motor loses 40 per cent. in the gear transmission. This means that 24 horsepower of energy must be carried off in heat. This is equal to 61,000 British thermal units of heat per hour. It is evident that heat liberated at this rate would burn all of the oil out of the gear case in a very short time.

The loss in efficiency for gear transmissions cannot be expressed as a percentage. This has been demonstrated by similar lines of experiment. This loss can be expressed only in foot-pounds, or a definite power loss which remains practically constant through a normal range of power, and which increases with the circumferential speed of the gears. On a percentage basis the loss is apparently greatly reduced as the speed is increased, but in reality the loss in power is greater.

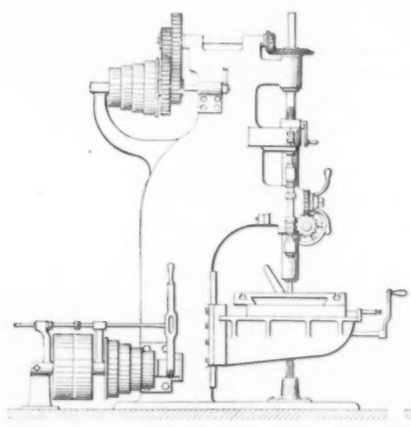


FIG. 1.

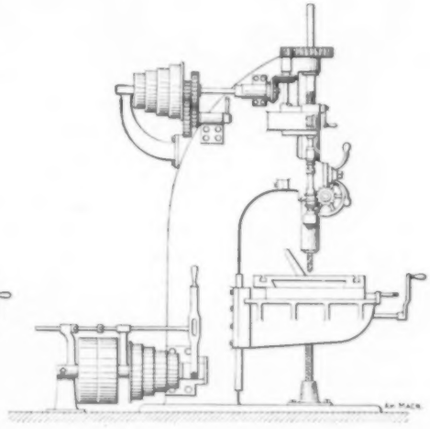


FIG. 2.

FORMER AND LATER ARRANGEMENTS OF GEARS IN VERTICAL DRILLERS

This is quite natural as the impact of the gear teeth is greater at higher speeds. All formulas for strength and wear of gear teeth reduce the load for increased speeds. Barth's equation is the commonly accepted expression for this, $\left(\frac{600}{600 + velocity}\right)$.

With this understood it is easily seen why the loss expressed as a percentage is confusing. The loss of 40 per cent. mentioned above was probably determined at light loads and with new gears. As an example, suppose the total output was 5.3 horsepower, and the input was 5.6 horsepower; the loss in power would be 0.3 horsepower and the efficiency in percentage 94.6 per cent. When the input was 18 horsepower and the loss still 0.3 horsepower the efficiency is 98.3 per cent. When the gears are running light and but 1¼ horsepower is the input with a loss of 0.18 horsepower the efficiency is 85.6 per cent.

It is not to be supposed that the power loss is constant for all gears of the same ratio—this loss varies with the pitch, and, I am beginning to believe, with the breadth of face, as the energy required to overcome these frictional resistances must vary almost directly with the size and form of the tooth.

When gears are running idle or under light load the loss in power is less than at normal load, although the percentage of loss is higher. This is shown in a series of tests made with a pair of Humphris spur gears 9 and 18 teeth 1.216 pitch. These gears were both of case-hardened steel, running in a bath of oil and mounted on ball bearings. The test was made after the gears were in service six months. See Table 1.

Horsepower Input	Horsepower Output	Efficiency	Horsepower Loss	
Pinion speed, 1260 revolutions per minute = 1060 feet per minute				
1.9	1.5	76.3	0.59	Light load
5.8	5.1	88	0.70	
9.8	9.0	91.8	0.80	
13.8	12.7	92	1.10	
17.8	16.7	93.8	1.10	Normal load 1.10
21.8	20.7	95.4	1.10	
26.0	24.7	95	1.30	
Pinion speed, 1120 revolutions per minute = 945 feet per minute				
1.76	1.3	73.3	0.46	Light load
5.23	4.67	89.3	0.56	
8.76	8.0	91.3	0.76	
13.3	11.5	92.6	0.81	
15.9	15.1	95	0.80	Normal load 0.80
19.5	18.6	95.4	0.90	
23.1	22.3	96.5	0.80	
Pinion speed, 980 revolutions per minute = 825 feet per minute				
1.6	1.4	87.5	0.20	Light load
4.7	4.3	92.1	0.37	
7.7	7.2	93.5	0.50	
10.8	10.2	94.4	0.60	
13.8	13.3	96.4	0.50	Normal load 0.60
17.0	16.4	96.5	0.60	
20.1	19.1	96.5	0.70	
Pinion speed, 840 revolutions per minute = 710 feet per minute				
1.43	1.27	88.8	0.16	Light load
4.00	3.73	93.3	0.17	
6.7	6.25	93.3	0.45	
9.3	8.8	94.7	0.50	
12.0	11.56	96.3	0.44	Normal load 0.50
14.7	14.2	96.6	0.50	
17.4	16.8	96.8	0.40	
Pinion speed, 700 revolutions per minute = 590 feet per minute				
1.24	1.1	88.8	0.17	Light load
3.4	3.16	92.8	0.24	
5.6	5.3	94.6	0.30	
7.8	7.5	96.2	0.30	
10.1	9.7	96.0	0.40	Normal load 0.35
12.3	12.0	97.6	0.30	
14.6	14.2	97.3	0.40	

TABLE 1. ANALYSIS OF TESTS OF HUMPHRIS GEARS

Other tests if analyzed in the same manner will, in all probability, show the same general result.

DETERMINING FACTORS IN GEAR EFFICIENCY

It appears that the efficiency of a gear drive is affected:

1. By the circumferential speed increasing in actual power loss as the speed is increased.

2. By the pitch and face of the gears, as explained.

3. By the number of teeth in contact—this factor has a direct influence upon the noise generated.

4. By the ratio of the drive; the loss in power increases the amount of reduction. Therefore, a ratio of 1 to 1 is more efficient than a ratio of 5 to 1.

5. By the form of tooth used and the accuracy with which the gears are cut and spaced.

6. By the condition of the tooth surfaces—a newly cut or roughened gear will absorb more power than a gear in which the teeth have been properly glazed. This is important.

7. By the length of time the gear has been in service.

8. By the method and quality of lubrication.

9. By the design and construction of housing or frame in which the gears are mounted.

10. By the fit of the gears on the shafts and the methods of fastening.

11. By the type of gear used and kind and proportions of the teeth.

It may seem odd to state that the power loss does not increase with the power transmitted. Instead of this being the case, the total loss has materially decreased for heavier loads in several tests that have been made. The last factor (11) is, of course, the most important of all, although all are important and must be considered when the highest possible efficiency is desired.

Gears may be divided into three general classes; spur gears, connecting parallel shafts; bevel gears, connecting shafts at an angle in the same plane, and skew gears, connecting shafts at an angle not in the same plane. Spur gears are the most efficient; next come bevel gears with the efficiency increasing as the angle of shaft approaches zero; skew gears are the least efficient. Skew gears include worms, spirals, and skew bevels. The spiral gear is a development of the bevel gear and the worm gear is simply an improvement of the spiral gear. So that in reality there are but two basic types of gears; spur and bevel.

Suppose for instance, that we consider a pair of shafts at right angles in the same plane upon which are mounted a pair of bevel gears, each 10 inches in pitch diameter. Lifting one of these shafts from this plane, or in other words, creating a center distance between them of any amount makes them "skew gears." It will be noted that the gears must be moved toward their apex as the shafts are separated, otherwise their diameter must be increased. When these shafts have been moved apart one inch the resulting angle of the gear teeth across the face is very noticeable. This angle increases as the shafts are separated, until it reaches 45 degrees, when the distance between the shaft centers is 10 inches, the same as the diameter of each gear, and the gears are directly opposite each other. In practice they are now made with straight faces and are called "spiral gears." We improve upon this by cutting the driven gear with a hob, a counterpart of the driver, and have worm gears. The Hindley worm or spiral gear is an attempt to carry out the original development. The efficiency of a pair of skew gears will vary with the relative distance between the shaft centers, or the angle of skew. As spiral gears are the extreme case, it is evident that bevel gears must be more efficient than worm gears, although the worm gear is an improvement over the spiral.

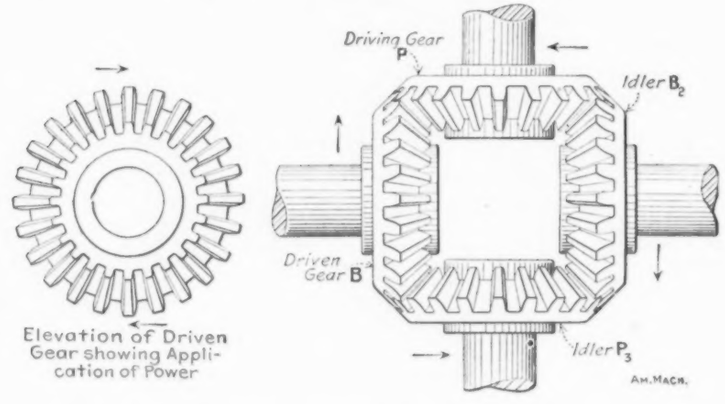


FIG. 3. BEVEL-GEAR ARRANGEMENT FOR AUTOMOBILE

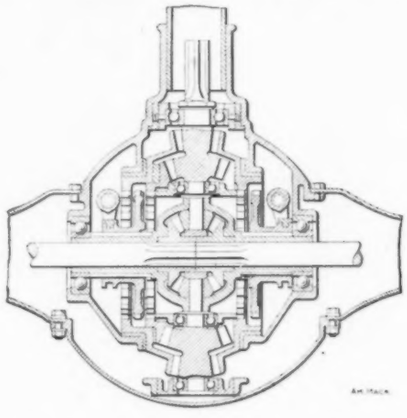


FIG. 4. THE COLLINS TRANSMISSION

THE WORM GEAR DRIVE

A few years ago the worm gear was considered a poor device, to be used only where a quiet drive and great speed reduction were required without reference to the loss of power. Lately, however, the penduloum has swung the other way and it is hailed by many as a panacea for all of the ills to which an automobile transmission is heir. Such is not the case. Before being carried away with the idea of a worm drive for automobiles, we should carefully consider the basic principles governing gear efficiency. Aside from the low efficiency, good worm gears are difficult to produce. This is especially true when multiple threads are used in the worm, as anyone experienced can testify. A great deal more care and expense is involved in producing quiet, efficient worm gears than is generally supposed. It is commonly accepted that the most efficient angle for the worm is 35 degrees. An examination of successful worm drives for heavy work confirms this.

When the engine is driving the car the worm, of course, delivers the power to the worm gear, but when the engine is disconnected, as in coasting, the gear drives the worm. To avoid undue friction under these conditions the angle of the worm should be 45 degrees, but 45 degrees is not the most efficient driving angle.

While the worm may be driven by the gear when the angle of the worm is 35 degrees, it creates a great amount of friction and wear, which is not a good condition.

When coasting, the gear will drive the worm as the friction caused by the unfavorable action of the teeth is overcome by the kinetic energy of the car, but the amount of resistance in this action is evidenced by the necessity of often having to remove the driving shaft before the car can be moved by hand.

Again, owing to the fixed angle of the worm and the limitations placed upon the diameter of the worm gears on account of road clearances, the worm-gear drive is confined to certain speed ratios. According to E. R. Whitney, at page 83, Volume 35, the worm gear is limited to reductions of from 6 to 1 to 14 to 1, therefore it is not suitable for light pleasure cars or heavy trucks. For heavy trucks, however, additional reduction may be obtained by means of a chain or spur-gear drive.

In an automobile transmission, owing to the position of the engine, a right-angle turn must be made, therefore bevel gears must be employed. Naturally, they have been placed on the rear axle as the last point of application. I say "naturally;" yes, the early cars were built that way and all have followed suit. We have a parallel of this in the driller. From time immemorial the bevel gear has driven the drill spindle, a point of application

where the speed is relatively slow and the load on the teeth high.

Now, the most powerful drillers are being built with a spur-driven spindle, the necessary right-angle drive being placed where the load is light and the speed high. See Figs. 1 and 2. This is the right idea for an ideal drive for the automobile, if it can be properly applied.

Sliding Gears

Sliding gears are a source of power loss, being of a necessarily loose fit on squared or splined shafts that are liable to be more or less out of true. The life of the sliding gear is relatively short, as the ends of the teeth are damaged in entering contact and the hardness best suited to the hammering action when thus engaged is not the best suited for wear. Gears in constant mesh may be made much harder than sliding gears. The internal clutch is to be preferred to the face clutch when using constant-mesh gears. It is desirable to have all gears not carrying a load out of commission. Therefore, it would seem desirable to disengage the gears driving the countershaft when on the direct speed, as arranged in the Cotta transmission, so that the bevel gears on the rear axle are the only moving gears. The direct high-speed gear is used the greater part of the time, especially with six-cylinder motors. Where ball bearings are not used hardened and ground steel contact is vastly preferred to steel and bronze, or, in fact, to any other combination, but the contact surfaces should be hard, not simply "heat treated" for strength alone. Case-hardening mild steel (under 0.20 carbon) seems to be the proper material to use. It is almost unnecessary to add that a mil'-alloy steel is to be preferred to straight carbon steel.

In some instances the change gears are placed close to the motor, the gear case being integral with the motor crank case. This does not seem to be the proper arrangement, as the heat of the engine is transferred to the gear case, which has trouble enough of its own in radiating the heat generated through losses in the gears and bearings. Also the multiplied torque must then pass through the universal joints to the rear axle and the driving shaft must be heavier. This also applies when the change-gear case is secured to the frame midway between the motor and the rear axle. If the weight of these gears could be kept low, why not place them on the rear axle with the driving gear?

As the face or pitch (or both) may be reduced as the load on the teeth is decreased, why not reduce the pitch of the change gears to which the power is first applied, maintaining the same face? This will increase the life and efficiency of these gears and decrease the noise. It is now common practice to make all of the change gears of the same pitch and face. This is not necessary, as the load is unequal on the various sets.

Bevel-gear Drives

A common source of trouble in bevel-gear drives is the angular thrust caused by the action of the teeth, allowing the driven gear to be partially pushed out of mesh. This action rapidly destroys the teeth, often causing them to break by throwing the load on the small end and disturbing the ratio of the pitch of the teeth in contact. Many automobile manufacturers endeavor to avoid this thrust by allowing the gear to bear against a spot on the gear case when the gear has sprung a certain distance, say 1/16 inch out of mesh, but by this time the damage is done. If, on the other hand, the "spot" is placed much closer than this it is liable to act as a brake the greater part of the time. In some cases a roller is used.

A bevel drive can be vastly improved by the use of two idlers as per Fig. 3. This arrangement balances the angular thrust and greatly increases the smoothness of action, strength and efficiency of the gear, making this combination equal, if not superior to a spur-gear drive. It is seen that the gear B is driven up on one side and down on the other, the gear P driving the down side direct and driving up on the opposite side through the idlers B_1 and P_1. If the gears shown in Fig. 3 are made 8 diametral pitch we obtain a strength equal to 4 diametral pitch, and still retain all of the advantages of the finer pitch as regards wear and smoothness of action. This arrangement has been used for several purposes, both in tooth gears and friction drives. It forms the basis of the Collins automobile transmission shown in Fig. 4. This drive makes an interesting study in gear mechanisms.

Herringbone, Helical and Spiral Gears

Herringbone gears are classified as spur gears, but are superior in every way to the spur gear, as it is commercially known. It is, therefore, advisable to use them wherever possible, although they cannot be employed as sliding gears. The efficiency of herringbone gears is too large a subject to enter into here.

Helical gears are inefficient on account of their side thrust, which increases with the angle of the teeth.

Spiral gears, while being inefficient, owing to the small amount of tooth contact, are often desirable on account of their quiet operation. The condition of the teeth when put into service is a large factor in this case. The general efficiency for spiral gears is the same as for worm gears. The loss expressed in percentage is fairly correct, the load being transmitted by sliding friction. This is not the case with spur and bevel gears. It would be well to note again that the efficiency of worm gears is governed greatly by the condition of the teeth surfaces when put into service. This point cannot be brought out too strongly. Also the spacing of the teeth needs special attention, as the hob has a habit of making a poor job in this respect through no fault of its own.

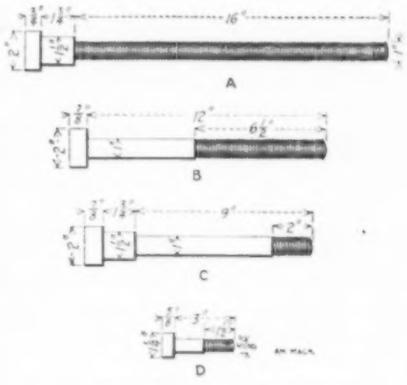
Getting back more closely to the original subject, gear efficiency, I would suggest the following values for trial, to be used in connection with the single bevel-gear drive on the rear axle.

Revolutions per Minute	Horsepower Loss
1500	0.90
1200	0.60
1100	0.40
1000	0.30
900	0.25
800	0.20
700	0.17

In this article I have endeavored to put forward a few facts on an important but little understood subject, with the hope of "starting something."

English Turret Lathe Jobs

The work shown in the accompanying cut was produced from 2-inch mild steel black bar, at the Turin Exhibition, on machines built by Alfred Herbert, Ltd.,



Turret-lathe Jobs

Coventry, England, A, B and C being made on a No. 2 hexagon turret lathe in 10, 5½ and 4½ minutes respectively, and D on a No. 2 automatic screw machine from 1 5/16-inch bar in 98 seconds.

The filing of clippings from the technical magazines, papers before engineering societies, correspondence containing technical matter, blueprints, tables, etc., reports of test drawings, and similar matter cannot be wholly relegated to a clerk or inexperienced office assistant, since such matters cannot be filed in proper shape without first being read through and the contents digested. An article describing the manufacture of air brakes, for instance, might contain a very excellent discussion of some phase of machine-tool operation, so that its proper place for the office in question might be under the heading of some particular machine tool.

Indexing Technical Articles

By Henry M. Wood*

Details of a method for making a card index for special classes of papers and clippings.

The way to classify and file the material gathered.

"Why does not some publishing company compile an index of all the articles that have appeared on machine building during the past several years? . . . . A publication like the AMERICAN MACHINIST has a possible value as an excellent permanent record that can only be completely effected by a means of referring readily to back numbers. . . . . Very frequently, when a superintendent has some question to solve, he remembers having seen an explanation of a similar problem in the AMERICAN MACHINIST, but, as he cannot recollect in just what issue it appeared, and also as he has no method of quickly finding this out, he gives up reference as a hopeless task; thus he loses much of the value of the AMERICAN MACHINIST as a permanent record."

The foregoing is quoted from a contributor's article on page 448. It expresses a need which many have felt. But it is not necessary to do without an index merely because no published index satisfactorily covers the field.

MAKING AN INDEX

Business men and engineers alike know the value of a card-index system for shop and office records. A similar index can be made proportionately just as valuable in the technical library, as the next best thing to knowing something is to know where to find it.

A card index for personal use can be made a record of anything that may come in handy at some future time. Technical articles can be conveniently indexed and referred to either in the original magazine or in a book of clippings. Advertisements of distinctly new and improved machines, indexed in a similar manner, are often desirable for superintendents and men in similar positions. Books should always be indexed under their general subject headings, and in addition if certain chapters treat other topics which would be thought of under other heads, such chapters may well be indexed as separate articles. Odd scraps of information, formulas, and clippings of all sorts, can be covered by the same index. It is a great advantage to have but one index for everything, as there then is just one place to look for a given subject.

You will naturally include in such an index, only those topics which are of personal interest, and you will cover these topics more thoroughly than a published index would. Furthermore, your own index will not be cluttered up with a mass of general references. Guard against wasting time by promiscuous indexing. Cover only articles such as you are reasonably sure to want to put to some specific use, as there are several published indexes to periodicals which answer nicely for general references.

*Lodge & Shipley Machine Tool Company.

BINDERS FOR CLIPPINGS

In each issue of your favorite technical journals, you find some articles of special interest which you want to preserve. There are also many more articles which you do not care for, and will never have occasion to use; to save the magazines complete would result in a big accumulation of this needless matter. Therefore to be most efficient, the card index must be used in conjunction with some convenient means of filing clippings which suits the individual case. Numerous plans have been described in various magazines, each good for many cases, but none suited to all. I have tried a separate envelop for each clipping, writing the title on the outside of the envelop and filing the envelops alphabetically just as index cards themselves would be filed; this proved too clumsy a plan and the larger pages had to be folded so many times that they were badly mussed. A vertical letter file was nearly as bulky and harder to keep in order. Pasting the clippings into a bound scrap book is not satisfactory because it is difficult to remove obsolete matter, because there is no way to interpolate a new clipping between two old ones to keep kindred articles together, and because usually both sides of the printed sheet must be equally accessible.

Now I am getting entirely satisfactory results from two loose-leaf binders, and believe this is the plan best suited to usual requirements.

The AMERICAN MACHINIST and a number of other journals are 9 by 12 inches standard size. Some magazines and many catalogs are 6 by 9 inches. I selected these two sizes for my binders, as probably accommodating the largest number of clippings without trimming or folding. Odd-size clippings may require a little cutting, folding, or pasting to get them into shape for one or the other of the binders, but such extra work is very slight.

My binders are homemade, consisting merely of tough fiber covers, each with two holes punched at the left edge. Clippings are punched to correspond and held in place by McGill paper fasteners. The binders are not so neat in appearance as spring-back binders, but are much safer as the papers cannot possibly spill out, and are much more elastic as the number of clippings one binder will hold depends only upon the length of the paper fasteners used.

Clippings are numbered consecutively as they are inserted, because the binder is a file rather than an index; the index card will locate the clipping by page number. It is convenient to use but one serial number for each clipping, no matter how many pages the clipping may contain, placing the serial number in red ink at the top of every right-hand page. If, however, it should be desirable to interpose pages between two clippings that are already numbered, in order to keep related articles together, it can easily be done by decimal numbering. For example, two new clippings can be inserted between old numbers 33 and 34 by numbering the new pages 33.5 and 33.6. Similarly a page can subsequently be inserted between 33.5 and 33.6 by giving it number 33.55.

The binders themselves are designated as No. 1 and No. 2. Then the index card for each clipping bears the number of the binder as well as the page number to locate the clipping. The subject heading under which an article is to be indexed, is written in red ink across the top of the first page of the clipping. Each binder has a fairly large capacity, and the system is elastic so that "dead" matter can be at once removed from both the index and the binder; thus just one binder of each size will answer in most cases. If one of the binders should be completely filled, it may be laid aside and a new one started as No. 3.

THE INDEX CARDS

Standard 3x5-inch ruled white cards are used for the index. These can be obtained at the larger stationery houses, punched to suit whatever style of locking device you prefer for holding them in place in their filing drawer. At the top of the card write the subject under which you are to index that book, clipping, or article. It requires but a trifling amount of additional time to write the subject heading in red and the balance of the card in black ink, and it is well worth doing because of the greater distinctness with which the subjects stand out all through the index. On the line beneath your subject heading write the author's title of the article, following with author's name, name of the magazine or book in which the article is found, the date, or volume, page number and length of article. Give a brief outline of the nature of the article to in-

dicate its probable value for future reference. If you have cut out the article and placed it in a binder, add the binder number and page.

Use a separate card for each article or clipping, no matter how many cards this may bring under one subject. If the article is long, all of the card will be needed for an adequate synopsis; and if the article is short, or merely a formula, all of the essential information often can be placed directly upon the index card, making further reference unnecessary.

Choosing the Subject Heading

Do not use the author's title of an article as the heading of your card. Index every article under that word which most closely expresses its main subject—selecting the subject which appeals to you as comprehensively covering the case—and you will then be able to find the card more easily when some time later you want to look it up. It is important to select a suitable heading for each of the cards; a little thought on this point will be well repaid by the ease with which subjects can be found. If you have access to a good engineering index use its subject headings as a guide; but it is unlikely that anyone's else subjects will exactly suit you.

Subject headings should always be in the singular rather than plural, except where subjects are thought of in the plural only. That is, a heading would be "Lathe," not "Lathes;" although "Calipers" is all right. Put compound names under the first word, unless some other is more significant. That is, "Machine Tool," rather than "Tool, Machine."

If the article has two or more *different* subjects, *not related*, put it under as many headings. For example, "Application of Motor Drive to Machine Tools" would be indexed both under "Electric Motor" and "Machine Tool." In such a case make no cross-index card referring from "Machine Tool" to "Electric Motor" or *vice versa*.

Similarly, it is often desirable to enter under a separate heading a subject that fills but one chapter of a book. That is, if a book on factory management has a particularly good treatise on routing, index the book itself under "Factory Management;" also index the chapter on "Routing" separately under that heading, where you can give a more complete synopsis than on the main index card.

Cross-indexing

Frequently you will be in doubt as to which of two or more subject headings to use to best express the *same* idea. In such cases choose one title for the regular record card, and also cross-index by filing a card under each of the other possible titles, and referring on the cross-index cards to the subject heading of the main record card. Cross-index cards should be made out in red ink to distinguish them readily from the record cards. Cross-indexing freely keeps your index in such a form that anyone can use it, and also prevents your losing your own cards, in case you should have forgotten—as you may have in a few months or years—the exact subject under which you indexed a certain article. An illustration will make this clearer: Suppose you want to index an article entitled "Machine Shop Organization and System." The term "Management" covers both "Organization" and "System," and is, therefore, a better word for your own subject heading than either or both of the words used by the author of the article. Your next thought is that the underlying principles of management are the same, whether applied to the machine shop or to a mill. The word "Factory" might be chosen as including different kinds of shops and mills. You would then write "Factory Management" as the subject heading on the index card for this particular article.

But it would not be sufficient to stop there. Later you might remember having seen an article on machine-shop system and look for it in vain under that heading. You should, therefore, have a number of cross-index cards, one filed under each of the other possible subjects, as follows: "Machine-Shop Management. *See* Factory Management;" another, "Works Management. *See* Factory Management;" another, "System, Factory. *See* Factory Management," and so on. Such cards, on which the reference is merely *see*, indicate that no subject entries are made under the heading referred from. Thus *all* cards on a given subject are brought together in the index under *one* subject heading.

In other cases, it is necessary to refer from one subject to another *related* subject. The cross-index cards are then marked *see also*. For example, if you have cards under both of the subject headings "Labor" and "Wage System," and if you think added information on "Labor" would be had from some of the articles indexed under "Wage System," make cross-index cards reading "Labor. *See also* Wage System" and "Wage System. *See also* Labor."

Subdividing

Whenever you have a great accumulation of cards under one heading, it is well to subdivide. Suppose when starting the index, you had put everything pertaining to machine tools under that head, with cross-index cards referring from other subjects, as "Lathe. *See* Machine Tool" and "Miller. *See* Machine Tool" and "Bearing. *See* Machine Tool," etc. Later you find this gives too many cards under the subject heading "Machine Tool." Then subdivide the subject by placing all lathe articles under "Lathe," etc. You will probably have left in your index general articles under "Machine Tool," which would be useful when looking up certain of the subdivisions, such as "Lathe;" if so, change the *see* cards referring from "Lathe," etc., into *see also* cross-index cards, as "Lathe. *See also* Machine Tool," etc. But if you have no card under the general machine-tool heading pertaining to bearings, do not keep any cross-index card referring from "Bearing" to "Machine Tool." Make one only *see also* cross-index card reading "Machine Tool. *See also* Bearing, Lathe, Miller, Planer, etc." This will separate your accumulation of machine-tool cards into a number of smaller groups for more convenient reference. A general article, such as "Influence of High-Speed Steel on Machine-Tool Design" would be placed under "Machine Tool." An article treating of one particular machine would be placed under its special heading. Do not enter the same article under the specific subject and also under the general including class.

This subdividing can be carried out just as far as your particular needs warrant. If you are specializing on articles covering lathe design, you might find it desirable to make a *see also* card under that topic, "Lathe. *See also* Carriage, Headstock, Tailstock, etc."

Note that but one *see also* card is made under one heading, and that all of the related subjects referred to are alphabetically arranged on that card. Also remember the general rule to refer *from* the large or general heading *to* the small or minor heading.

When subject headings are chosen and subdivided as just described, with cross-reference cards properly made out, you will not be annoyed by finding that your cross-indexing leads you around in a circle back to the card from which you started. You will also be able to find readily all articles in your index treating any one topic.

Where there are several motors of the same type, it is advisable to keep a number of bearings in stock, ready for use. Since the journals on the motor shafts wear in time, it would be impracticable to bore all the bearings the same size. The best plan is to keep in stock bearing bushings standardized, say, to three sizes differing slightly in diameter; the small size to be used on new shafts, the second for shafts the journals of which have worn enough to justify turning them down to the diameter necessary to take the second standard size, and the largest size of bushing to be used in a similar way for journals that need turning a second time. In boring the sleeves an allowance should be made, in order to take care of oil and unavoidable irregularities, of 0.002 in. per inch diameter of bearing for solid sleeves and 0.003 in. per inch diameter of bearing for split sleeves—*Exchange.*

A File Order Cabinet

The halftone illustrates a handy cabinet in use at the shops of the Taft-Peirce Manufacturing Company, Woonsocket, R. I. The cabinet is placed on the wall near the tool-room window, and contains a sample of every shape, size and cut of file used in the plant, with a number attached directly opposite each file point. When a man wishes to secure a file from the tool room he simply orders it by its number, as given in the cabinet.

Machinery Notes from Cuba

By Fred H. Colvin*

There is every indication of a very large crop of sugar cane this season and the mills are preparing for a prosperous grind. Many are enlarging and all are making the usual "off season" repairs. This is reflected in all lines of machinery used in sugar making, which now includes electric motors to a large extent, many machines, such as centrifugal separators and pumps, being independently driven. The motors come from all parts, German makes being considerably in evidence as well as standard American machines.

Machine tools are not included in the demand except for repair work at the various mills or for the smaller jobbing shops, which handle anything that comes along.

American small tools are quite largely in evidence in show windows, even where no one in the store speaks a word of English. Drills, taps and dies, especially for pipe work, are nearly all American as the Briggs standard pipe sizes are used almost exclusively. In most cases the pipe itself comes from the States, but the United States standard sizes are demanded in nearly every case. I was also informed that the United States standard bolt sizes prevail, but could not verify this and the large number of English, German and French machines make it seem a little doubtful. Of course, the Whitworth and United States standard threads interchange quite readily in most cases, which may give rise to the statement, while the fact that they do interchange so well makes the standard adopted of less importance.

Sugar-mill machinery and appliances come into Cuba duty free from all countries, over 25 per cent. preferential duty not holding in this case. Whether as a result of this or not, most of the sugar-mill machinery comes from Europe, Germany being largely represented.

In the Machine Shops

Machine shops, most of which are small, have a fair sprinkling of American machines in them—nearly all the later lathes, planers, etc., being of well known makes in the States. Most of the older machines are of European make. This is true of the railroad shops, the dry dock and the small repair shops in power plants and the job shops. There are also a number of wood-turning shops, mostly equipped with the wooden bed lathes of long ago.

Small internal-combustion engines and pumps are quite largely used, two large American concerns being well represented.

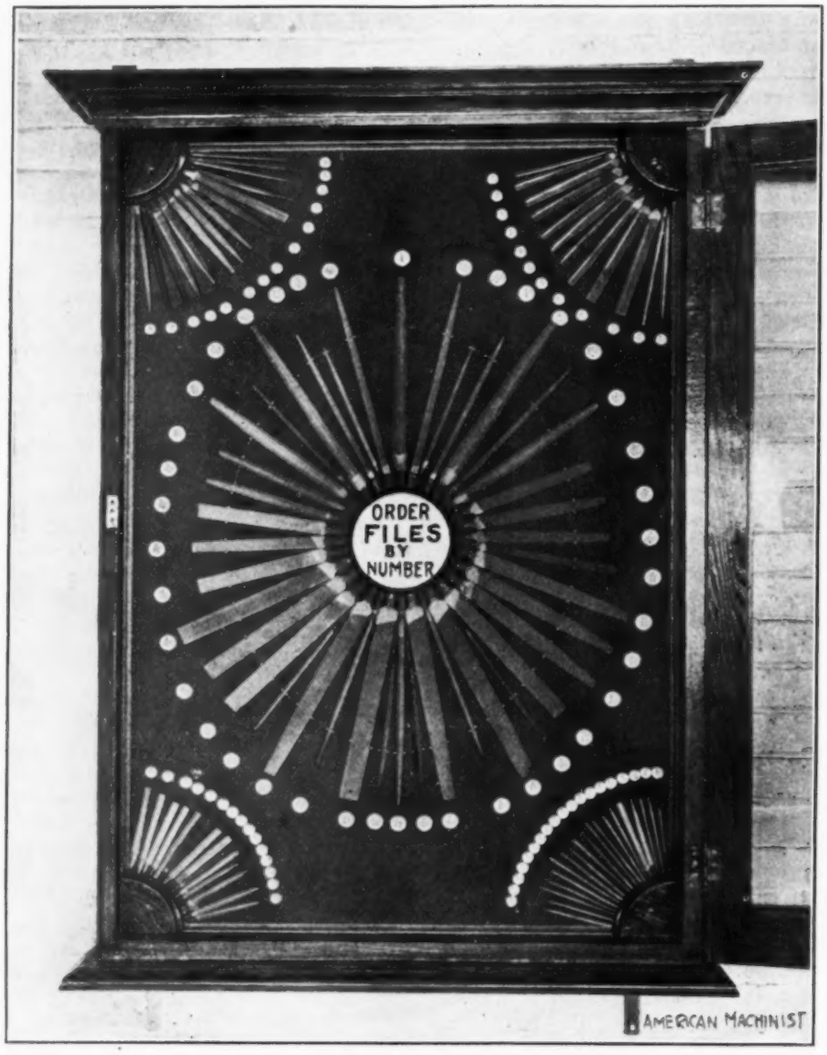
Owing to the high cost of gasolene, 40 to 50 cents a gallon, alcohol is quite largely used in its place. This simply requires a different mixing valve on the engine. Alcohol is not considered so good a fuel, pound for pound as gasolene, but for small engines in the country, near the sugar mills which make alcohol from refuse, they can be run very cheaply. The fuel—denatured alcohol—can be made for from 10 to 20 cents a gallon and shows quite a saving in cost, even after allowing for its lower efficiency.

Until more manufacturing that uses machinery has developed in Cuba the field for machine tools must be largely limited to the repair shops. Many of the shops have very old tools, however, and these are being gradually replaced, usually with American machines. This offers something of a field, but one which can best be filled by machines of plain and substantial design, although not necessarily what we are pleased to term high-powered machines, Repair work very seldom calls for that kind of cutting.

Nearly all the mechanics are natives of Cuba and some of them seem to do remarkably good work. But it should be remembered that, while a good substantial machine is required, there is little need of many of the attachments and refinements, which some consider necessary in the States. Nor is extreme accuracy required in many cases.

Manufacturing is bound to come sooner or later and it is a good plan to get the names and the good points of the American machines so fixed in their minds, that there will be no question as to which will be ordered when the time comes.

*Managing editor.



A File Cabinet

Wage Systems in Germany

By B. Buxbaum

How the various wage systems are looked upon by the German workman.

The advantages and limitations of profit sharing.

In general, European workmen are more strongly opposed to all premium plans than they are to even piece work, with which at present they seem to be fairly well satisfied. They feel that a rate which cannot be made until after the conclusion of the work cannot be just—quite in contrast with the feeling in America. Furthermore, it appears that the American workman is more ambitious than the European, as he gladly accepts a system that allows him to earn more by simply using his energy at a greater pressure.

It goes without saying that complicated premium systems which the workman cannot readily understand arouse distrust and dissatisfaction. The same suspicion is frequently noted against profit sharing in any form. The European workingman always wants his wages in cash and he opposes every pay day at the year's end. Unfortunately the European workingman seems not to recognize the premium or profit as such, but adds it as a part wage to the rest of his earnings, since he, very erroneously, of course, cherishes the conviction that he is being paid at most only a fixed wage rate. At all events, whatever the form of payment, there is a demand on the part of the workman that the premium base rate be changed only in the following cases: For alteration of construction, of working methods (machine tools, fixtures, order of operations) or of the number of pieces in the series of work.

Wage Scale Agreements Existing in Germany

Collective labor agreements (scale agreements) are designed chiefly for regulation by contract of the following points: Wages, share in fixing the wages, minimum wages, working time, vacations, right of association, equitable intelligence offices, workmen's committees, commissions for adjustment of difficulties, material and mental betterment of the workman.

Although wage-scale agreements have found their way into the minor trades in Germany, into factories paying time wages, and into those which are practicing quantity manufacture entirely (such articles as bicycles, electrical apparatus, etc.), still this wage system has shown itself to be unsuitable for the large industries, particularly for machinery building. From purely technical considerations machine construction is ill-suited to confinement in rigid forms, its methods of work changing almost from day to day. On this account a piece-work system introduced today may be changed tomorrow in consequence of altered manufacturing methods; hence a shop hampered by wage agreements made and fixed for years would have great difficulty in adapting itself to new methods, and would be in danger of losing its ground against domestic and foreign competition.

The machinery industry also turns out such a great variety of work that all the pieces cannot be provided for by scales in advance. There are machine-building shops in which over 1000 different piece scales are set. Properly, wage agreements usually come in question only for those plants which previously have paid by time, not for those which have been on a piece basis.

Wage Scales in Government Work

By a resolution adopted recently, the Reichstag expressed its desire that government contracts be given only to shipyards that have adopted the wage scales or were not lower than the locally prevailing scales. The State Secretary of the Imperial Navy Office did not see his way clear to comply with such a rule, but was essentially favorable to the idea. It is peculiarly pertinent that the government, in its own official shops, will accept absolutely no assistance in the matter of wage adjustment from the workmen, and it is interesting to read the statement of the Bavarian Minister of Commerce, a few years ago, in answer to a similar motion made in the Bavarian Chamber of Deputies. He said, in part, as follows:

"As regards entering into scale agreements, I may deny their admissibility as far as the workmen in government shops are concerned, even at the risk of being charged with unprogressiveness and a domineering attitude. In private industry the government favors scale agreements, because they check serious business unsteadiness. But in the public shops conditions are different, namely, in respect to control of the business side. First of all, the public authorities are not so independent in their financial aspect as the private works, but are subject particularly to the right of the Chamber to fix the budget. Then too, the public workmen have in parliament and in public opinion a representation which the private workers lack.

"Moreover, there is still to be considered the question with whom the government should enter into such scale agreements. Since there are several labor organizations, such a regulation would be difficult to follow. How about when one of these organizations is averse to the agreement or pronounces it to be unnecessary? In general, there is no material need for the introduction of the scale agreements in public shops and no actual interest of the workmen is involved."

These remarks are by no means entirely correct. First, the conditions in public shops are very different from those of private industries. The private industry must meet a sharp war of competition of which public industry knows nothing; further, its workmen obtain, through the social democratic parties, an energetic representation which the government employees lack. Moreover, it is incorrect that the promulgation of scale agreements counteracts business unsteadiness, for industries working with wage scales have encountered very severe crises.

To pass a conclusive judgment upon the scale question is impossible at present; we are still at the beginning of its development.

Constitutionally Governed Works

In contrast with France, England, Holland, Switzerland, and the United States, there are very few plants in Germany where the workmen have a share in the profits. Opinions on this manufacturing system naturally are divided. Some look upon it as a proper recognition of the claim of the employees to a share in the profits obtained through their labors; others see in it a method by which the employer, under pretext of benevolence, brings in a sort of slavery. The condition, however, is never so crude as all that, and the workings of the constitutional factory systems in this regard ought never to be confused with the demoralizing results of many earlier wage systems; for instance, the "truck" or company-store system.

When we look about in Germany to investigate the progress of constitutional manufacturing systems in industry, attention falls primarily upon the Zeiss Optical Works at Jena and the activity of the late Ernst Abbe, father of modern microscopy, partner and successor of Carl Zeiss, and developer of the enterprise. He sought to formulate a system that should not be degrading for any person whatever, for even him who earned his bread as a common laborer in the shop. He wished, by interesting the individual in the whole to introduce a new intermediate condition for the workman, which, while not being identical with the old handwork system, should stand vastly nearer to it than the status of the modern

laborer. However, he thought that to make a practical and thorough change was only possible with the aid of the state.

The Profit-sharing Plan Introduced by Abbe

The profit-sharing plan introduced by Abbe is not of the kind that is usually implied by that term. He regarded the ordinary plan as faulty or even a delusion. The Ziess profit sharing consists in a sort of rising scale as an addition to the fixed wage. This wage, or salary, when once it has been received by a workman, or official, for a certain time, must never be cut, except when the employee becomes incapacitated to carry on the work and is pensioned. If the contingent bonus were not allowed for, the enterprise would, during times of economic depression, be ruined by too high fixed wages, but it is saved by the variableness of this excess over the positive amount. This share in profits is allowed at a definite percentage to all employees outside of the management. This last point is essential, since it is the management that fixes the amount of the dividends; therefore it must not be biased by personal interest in the matter. This bonus to the employees upon their fixed wages or piece earnings varies between 4 and 10 per cent.

Abbe's provision that the wages shall be constant is of especial importance; the wages suffer no interruption by holidays and shutdowns. A second important point is a retirement indemnity which throws an obstacle before dismissal on two weeks' notice or, as generally happens elsewhere, without such notice. At the Zeiss works those employees who are laid off without ground must be indemnified. The indemnity, is on the same basis for everyone from workman to manager. At the end of three years it amounts to as much as six months' wages or salary. A man must have been employed at least six months before the plan takes effect. This rule is especially significant in connection with the pension plan, since each who loses the right to the pension fund receives more or less compensation through this indemnity.

It is quite noteworthy in connection with the Zeiss organization that the works founded by him have been transformed into an impersonal enterprise, a legal personality, standing under state supervision, which for all time renders it impossible for the enterprise to amend its own constitution. No individual can acquire the profits, but they remain entirely for devotion to the purposes named in the foundation. Extraordinary means are provided for various social welfare arrangements, for subsidizing the University of Jena in return for scientific contributions to the success of the works, and for the reserve fund of the establishment. It must be remarked that the workmen have no share in the commercial and industrial management of the works and exercise no influence upon them.

Imitation of Zeiss Foundation Not Easy

However important the place in German economic life occupied by the Zeiss foundation, its imitation by other branches of industry is not a simple manner. First, there is to be considered the equation of Ernst Abbe's extraordinarily strong and unselfish personality. It must also be borne in mind that manufacturing conditions here are peculiar; the increase in value from rough glass to finished lenses and from metal stock to optical instruments is so great that there is hardly any parallel to it in the machinery industry. The Zeiss works, their unusual shop methods, their preponderant employment of manual operations, and their consequent high wage budget relative to material cost, may be compared with quantity manufacture in the building of machinery, especially medium and heavy; this comparison will suggest some of the difficulties that would attend the application of the idea to the machinery industry. It is very likely that a large part of the German labor forces would fail to harmonize with such a system, since they lack the requisite maturity and are slow in grasping the reasons, as shown in connection with the premium system.

It seems probable, also, that the elimination of a private investor, with his capital, his keen interest, and his initiative, would greatly endanger progress in many branches of industry; further, many lines could hardly sustain a cooperative pay system that does not stimulate the workmen to the highest efficiency. Whether, finally, it is proper to interest the workman in the total profits and losses, the workman who has no influence upon the great speculative factors of the work, the purchase and sales, the intellectual task of the management, the outside war of competition, etc., seems to me more than doubtful. Each ought to be financially interested in the good and ill of only those conditions which he can exercise a direct influence to shape. And it is not just that the lazy workman should gather the fruit of his diligent comrade's work. Finally, that the workmen do not want to wait a year or half a year for a part of their wages has already been fully demonstrated. Experience teaches that only those wage plans please a man which carry their reward directly in sight. Even in large gang piece-work interest diminishes with the increasing size of the groups. The workman says to himself, "Any excess that I earn will be divided among all." He does not, however, tell himself that his increased work will stimulate the others. All of these plans lack the direct, quick evidence of the enhanced earnings.

Freese's Plan of Productive Cooperation

An instructive example of constitutional factories or productive coöperation is the well known large German woodworking establishment, Heinrich Freese, in Niedershönhausen, which has given its employees a far-reaching right of participation in management and profits.

The proprietor of the Berlin blind factory, Heinrich Freese, Jr., instituted workmen's representation in July, 1884, and entered the first scale agreement in December, 1884. The 9½-hour normal working day was introduced in March, 1887, and a trial of the 9-hour day was made in March, 1890. In March, 1902, the introduction of the 8-hour day took place. The introduction of the profit sharing by officials took place in 1888, and by the workmen with 2 per cent. of the net earnings in January, 1891, this being raised to 4 per cent. in December, 1894, and to 7½ per cent. in February, 1897. In November, 1905, the Heinrich Freese blind factory celebrated the twenty-fifth anniversary of its existence. The increases in the widows' pension took place in March, 1907; the widows were pensioned to 12 marks per month and the old-age pensions were increased to 20 marks per month.

There have been introduced into the Heinrich Freese factory numerous welfare arrangements which primarily are attributable to the initiative of the head of the establishment, partly, however, to the self-government of the working force and their representatives. There are also in the factory at present an aid fund, the widows' and old-age pensions, a factory savings fund, a Christmas savings fund, a mutual fire-insurance fund, and, furthermore, noteworthy provisions for the uplift of the workmen, for gardens with children playgrounds, a factory library, summer vacations, etc. The most important progress beside the workmen's representation and the 8-hour day is in the education of the employees to cooperation with the employer through profit sharing by officials and workmen.

Herr Freese goes so far that, in accordance with the desire of the continuous employees, he allows even the season hands a share in the net profits, because they can do much good or harm to the business if so disposed.

Herr Freese does not deny that he has followed the profit-sharing road slowly, but he expressly states: "I have always advanced a step at a time and I counsel everyone who will follow to proceed in the same manner. The way, however, is the right one. It leads to success." He also gives the following advice:

Salient Features of Freese Plan

1. "The sharing of profits must be regulated by fixed rules: the portion both of the employees as a whole and of each

individual must be preserved from capricious adjustment.

2. "A separate distribution for officials and workmen is permissible.

3. "For the allotment, the salary and wages paid are the best measure.

4. "The property right of the distributees in their shares is to be recognized. No share must be lost unless it justly may be withheld.

5. "The payment, at least of half the share, must be made in cash or in saving-fund books. The rest may be retained for a pension or aid fund.

6. "The account must be audited by a book inspector.

7. "In considering a revision of rules, a workmen's and an officials' committee must be present."

Voluntary Welfare Provisions

Finally, I must not omit to mention the voluntary welfare provisions that have made constant progress in large German works, at least in those which make good profits. The considerateness of the modern employer has naturally a different character from that expressed in the earlier "truck system." The present paternalism extends to intellectual and moral provinces, through the foundation of schools, libraries, educative societies, nurseries; to the bodies of the workmen, through sick funds, vacations with pay, hygienic shop fixtures (heating, lighting, ventilation, drink, dining rooms, factory gardens, and all the numerous health measures introduced under the influence of factory inspection); to the economics of workmen's families through encouragement of thrift by saving funds, sickness and death funds, loans without interest, cheap and good supply of necessaries; and finally, to care for the aged by means of pension funds and sanitariums.

Aside from the purely altruistic point of view, the establishment of such institutions naturally expresses the strong wish of the employer to develop an efficient, settled body of workmen. And it cannot be mistaken that the workmen, especially those with families, are glad to avail themselves of these welfare provisions, in spite of the influences on all sides of them opposing voluntary benevolence. On this point the German employer occupies a standpoint away from the American idea, since in America it is the view that welfare arrangements at their best can serve only to strengthen good relations already existing between employer and employee, but not to create them.

The amount expended for welfare work by German employers places a huge burden upon industry by the obligations of sickness, accident, invalid and old-age insurance, taxes, etc.

The Increase in Wages

In conclusion, I shall present a few figures showing the increase of wages in Germany, paying attention only to the metal industry. An investigation by Heinrich Göhring, Bremerhaven, comprising the wages in 300 German cities, showed the following average wages per hour:

	1903	1904	1905	1906	1907	1908	1909	Percentage Increase of the Wage per Day
For machinists and fitters	8.8	9.5	10.0	10.6	11.4	11.9	12.7	39.2
Lathe hands	11.1	11.7	11.9	12.7	13.7	14.1	14.9	38.0
Smiths, etc	9.2	9.5	9.9	10.3	10.7	11.2	11.5	23.8
Molders, core makers, foundry workmen, etc	8.6	9.2	9.6	10.2	10.8	11.5	11.9	33.2

THE AVERAGE WAGE PER HOUR IN CENTS

The table shows the constant growth of wages, a growth which at the Krupp works amounted to 80 per cent. for the period from 1871 to 1909, while the prices of food in the same time rose much more slowly. Even considering the decidedly advanced rents and otherwise higher cost of living, there remains a very marked betterment in the living conditions of the German workman, in judging which we must take into account the statutory illness and accident insurance with a comparative relief from anxiety.

Hobbing a Face Spiral Gear Ring

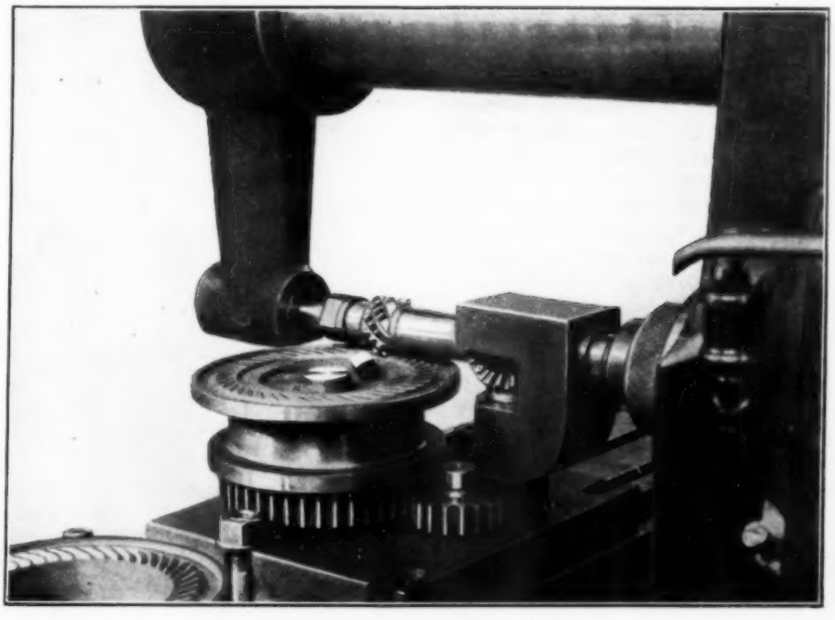
The halftone illustrates a method employed by the Acme Machine Tool Company, of Cincinnati, Ohio, for hobbing teeth in the flat face of a ring used for operating the spiral gears in the roller-feed mechanism of their combination turret lathe.

The work is a double-flanged casting about 7 inches in diameter, machined all over, and mounted upon a hub which is rotated by spur gears and bevels from the cutter arbor. The blank is secured to the fixture by the slanting set screw which presses a shoe against the inner wall of the work.

The miller table is located to bring one side of the flat face of the blank central with the hob, and the work is then fed vertically to the hob to the correct depth of tooth by elevating the miller knee.

The teeth in this flat gear ring present a peculiarly skewed appearance, this effect being produced entirely by the rotary motion of the work and the action of the hob without angular adjustment of the table or cross feeding of the blank.

The recent addition to the aëronautical exhibit of the National Museum, at Washington, of the original Wright aëroplane that was publicly flown under Government auspices is a noteworthy one. It will be recalled by our readers that this machine is the one in which the first official public flights held in this country were made at Fort Myer in 1908, and was described in detail at page 473, Volume 31, Part 2. The acquisition of this machine by the National Museum's aëronautical exhibit, already consisting of the steam and gasolene models flown by Langley, the Hargrave, Stringfellow and Lilienthal machines, and models of Chanute's gliders, calls for congratulation.



HOBBING A FACE-SPIRAL GEAR

Localized and General Illumination*

By G. H. Stickney†

There are four classes of practice in shop lighting, each suitable for particular lighting problems.

"The advice of an experienced illuminating engineer insures the selection of the most suitable arrangement."

Localized and general illumination mark two extremes of lighting practice. A few years ago, when practically all electrical illumination employed either the arc lamp or the carbon-filament incandescent lamp, the line of demarcation was more distinct, and practically all industrial lighting was accomplished with the incandescent lamp as localized illumination or with the arc lamp as general illumination.

The arc lamp, being efficient only as a large unit, was not suitable for localized illumination, while its higher efficiency gave it preference over the incandescent for general illumination.

In many cases combined installations have been made; that is, the general illumination from arc lamps has been supplemented by localized illumination from incandescent lamps.

The tungsten filament incandescent lamp, providing as it does a range of efficient units throughout the gap in capacities between the arc and incandescent lamps, has, as a result, been applied to installations having, more or less, the features of localized and general illumination.

We have, therefore, four classes of practice in shop lighting, namely:

1—Localized illumination with small lighting units,

2—General illumination with large lighting units,

3—Combined localized and general illumination with both large and small units, and

4—Localized-general illumination with units of intermediate capacity.

Localized Illumination

Localized illumination usually implies a carbon-filament incandescent lamp, or other small unit, hung over a machine or bench, mounted on a bracket or used as a portable. The lamp is usually under control of the workman, who (presumably) places the lamp so as to direct the light where needed. The area illuminated is relatively small, and the intensity falls off rapidly from the point of maximum illumination.

While localized illumination is being superseded in many cases by what I have called "localized-general illumination," it is particularly suited to certain conditions of manufacture. For example:

(a) Illumination of deep borings, molds, interiors of cupolas, under or inside of machines, or other places where a general illumination could not well penetrate.

(b) Illumination of straightening or inspecting processes, where the image or reflection of the light is specially employed.

(c) Illumination of very fine work, such as small-screw thread cutting, jewelry work, machine sewing (on dark goods) where an intense illumination is required over a small area.

Localized illumination is most economical where the surfaces to be illuminated are relatively small and widely separated.

As a rule a workman will choose this form of illumination, since the lamp is under his own control. Usually, however, he does not use it to the best advantage. Frequently he arranges the lamp so as to cast a glare in his own eyes or those of his fellow workmen. This results in eye strain and a demand for more intense illumination than would otherwise be necessary.

The common practice of using lamps without reflectors is not only wasteful of light, but makes it almost impossible to avoid glare.

Besides diverting the attention of the workman, the localized lamp, being sometimes held in his hand, precludes the utilization of that hand in his work.

Such lamps are often exposed to considerable breakage, and although low-priced lamps are used, the renewal cost is high. This, combined with the wear and tear on the extension cords, sometimes results in excessive maintenance expense, especially as the small unit makes necessary a large number of outlets.

General Illumination

With general illumination, an attempt is made to provide an approximately even intensity of illumination throughout a workroom. This ideal is never quite realized, except, possibly, when the lamps are hung at a considerable hight. The intensity directly under, or in the immediate vicinity of a lamp is almost invariably higher than at intermediate points.

Lamps are usually spaced equally throughout a room, independent of the location of machinery; hence no change in wiring is required by any changes that may be made in the position of machines. The most efficient illuminants are available, and since there are fewer outlets required, the initial wiring cost and maintenance expense are likely to be relatively low.

Where work is concentrated, requiring a particular intensity over a large proportion of the floor area, general illumination will usually cost less than localized lighting. The effect in the room is much more cheerful, and the foreman is enabled to exercise better supervision over his entire department.

General illumination is best suited to large, high shops, especially where crane ways require the location of the lighting units along the sides of the room or above the cranes. General illumination is especially desirable, on account of safety, where large, powerful moving machinery is used. It is commonly used in rolling mills, large, high machine shops, erecting bays, iron foundries, carpenter shops and similar places.

Combined General and Localized Illumination

There are many shops in which a low or moderate intensity will answer most requirements, but where a higher illumination is required either at a few localized points, or only occasionally. In such cases the combination of large and small units has often been used to good advantage. For example, a group of automatic screw machines requires but a moderate general illumination when in operation. But when a workman has occasion to set up or adjust one of these machines, a more intense illumination is required at that particular point. This can best be taken care of usually by a combined general and localized illumination.

For this particular purpose, since a workman ordinarily attends to a number of these machines, it is good practice to provide him with a lamp and short extension, arranging the wiring so that the extension can be connected or plugged in at convenient points near the machines. There are many variations of this practice, according to the requirements of particular shops.

Localized General Lllumination

I have applied this term to the practice of producing general illumination by means of units arranged regularly, but with reference to the machinery or processes to be lighted, so as to provide a higher intensity of illumination at important points than elsewhere. The units are located also with regard to giving suitable direction to the strongest light on a certain machine, thus avoiding objectionable shadows and reflections. The size of unit is selected to suit the spacing and amount of light necessary.

*Presented at the October New York meeting of the American Society of Mechanical Engineers.

†General Electric Company, Harrison, N. J.

This practice has followed directly as a result of the development of the tungsten filament lamp, which made available a series of efficient units throughout a range of capacities for which no provision had previously been made. This type of illumination is now being used to a very large extent for looms, lathes, and other machinery where the size and spacing of the machines is such as to permit fairly uniform spacing of lamps. It is also suitable for processes where lamps can be spaced over lines of benches or work tables. By varying the hight, spacing and size of unit, as well as the type of reflector, practically any character of distribution of illumination of suitable intensity can be obtained, ranging from the extreme of localized illumination to that of general illumination.

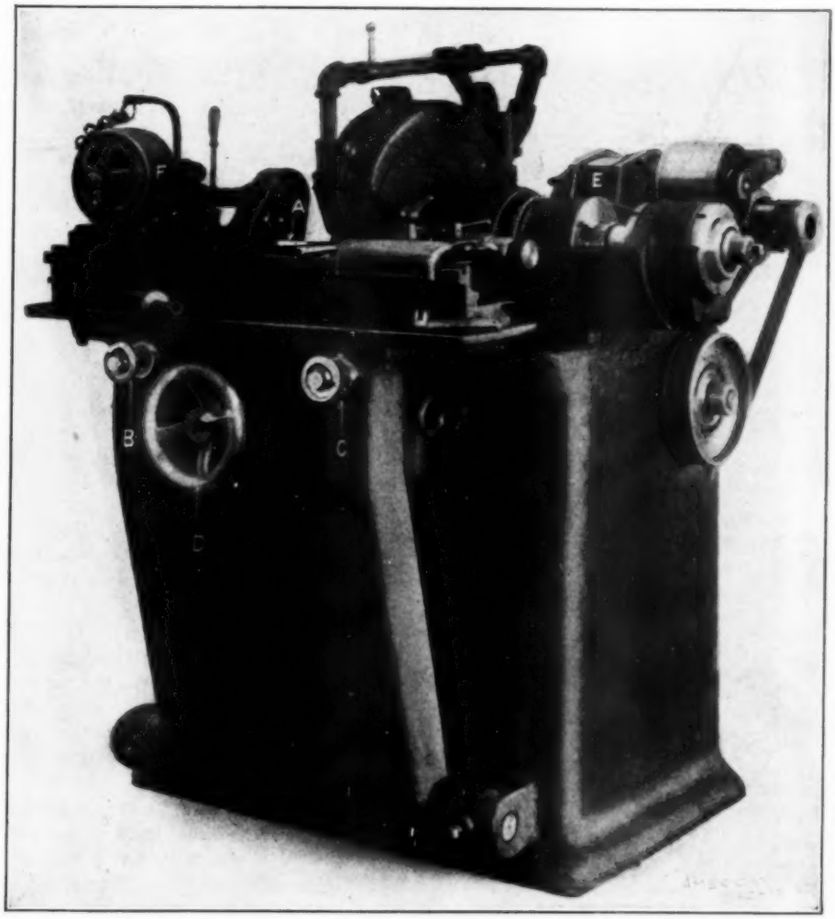
This class of practice embodies, in a measure, the advantages of both localized and general illumination. It may really be said to bridge the gap formerly existing between these two extremes, and is made particularly effective by the ability to select units of any desired capacity and equip them with reflectors which concentrate or spread the light over wide or narrow angles.

Localized-general illumination is distinct from localized illumination, in that the lamps are located higher and are not usually controlled by the individual workman, and from general illumination, in that the points of maximum intensity are located to suit the arrangement of machinery or other processes.

Conclusion

In the foregoing we have briefly outlined four different classes into which the practice in industrial lighting naturally divides itself. The development of new, efficient units has, in many cases, made a readjustment desirable so that a large number of shops are changing from one class of practice to another. Nevertheless, there are conditions, as we have already noted, which, at least for the present, will make it desirable to continue with each of the four classes.

It is hoped that these notes will be of assistance in the selection of the most suitable practice for particular lighting problems. Since cost of satisfactory illumination will frequently be the determining factor, it is urged that the determination be made on the basis of acutal installation conditions. The number of possible combinations is so large and the advantage of certain combinations, for particular reasons, so marked, that the advice of an experienced illuminating engineer is necessary to insure the selection of the most suitable arrangement.



A Special Grinder

Equipping an Up to Date Shop

We often wonder where the old machine tools go to and the following advertisement from a Panama newspaper may help to solve the problem.

NOTICE

Engineers and Machinists: The Pacific Mail Steamship Company has on hand at Naos Island (30 minutes from Balboa) the following pieces of machinery, together with shafting, belting and an assortment of tools, etc., which are offered for sale at a bargain. This is a fine opportunity for an ambitious man to secure good machinery and tools at a nominal figure. All are in good condition and represent the complete requirements of an uptodate machine shop:

1—18 ft. Machine Lathe, 3 ft. throw,
1— 8 ft. Machine Lathe, 12 in. throw,
1— 9 ft. Machine Lathe, 12 in. throw,
Manufacturer, Gould & Bro., Newark, N. J.
1—Shaper,
Manufacturer, Industrial Works, Phila.
1—Drill Press, No. 3,
Manufacturer, Industrial Works, Phila.
1—Pipe and Thread Cutter, Maximum 6",
Manufacturer, Forbes.
1—Combined Punch & Shear Mach., extra heavy,
Manufacturer, Fred B. Miles, N. Y.
1—Driving Engine, 18" Cylinder,
1—Planer 18"x8",
Manufacturer, Industrial Works, Phila.
1—Bolt Cutter with dies complete, ¼" to 2",
Manufacturer, Industrial Works, Phila.

It is interesting to note that the newest of these machines, as can be seen by the makers' names, is in all probability at least 20 years old and it is quite amusing to read that they "represent the complete requirements of an uptodate machine shop."

Advertisements are sometimes more strange than fiction and more humorous than Mark Twain himself.

A Special Grinder

By J. K. Tripp

A grinder built in the apprentice department of the General Electric Company, West Lynn, Mass., for grinding small shafts, bushings and other parts of less width than the grinding wheel, is shown in the accompanying halftone. The grinding wheel and spindle have no lateral movement. The wheel face is dressed with a diamond mounted in a bearing that is placed on a shaft between centers, shown at *A*.

The table is pivoted at the base of the machine and is pulled in toward the wheel by a lever and weight. Any slight taper in the work can be removed by adjusting one of the micrometer stops, *B* or *C*, at either end of the table. The handwheel *D* is intended only to draw the table and work away from the wheel, as all feeding of the work onto the wheel is done by the lever and weight previously mentioned, a dashpot controlled by a needle valve governing the rate of feed. This method of drawing the table in by means of a fixed weight insures the pressure being constant against the micrometer stops, thus doing away with any variation in moving the table in, which would be the case were a screw used.

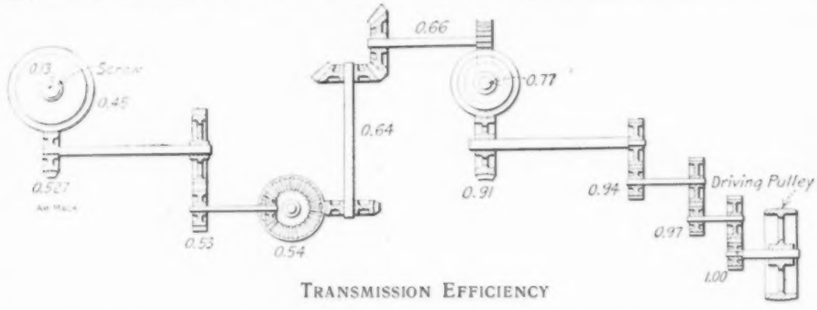
An unusual feature of this machine is that the grinding spindle and work spindle are driven by separate motors, *E* and *F*, respectively.

Transmission Efficiency

By Joseph Jewsbury

Efficiency, both of men and machines, is at the present time one of the chief topics in engineering publications. There is, therefore, no introduction needed, for an article pertaining to this question in its relation to machine tools.

Recently, I had occasion to determine, approximately, the proportion of power "input" to the useful power "output" of a particular transmission and as it was not convenient at the time to carry out a practical test, coefficients of friction decided upon from local conditions and calculation were resorted to.



Transmission Efficiency

Roughly, the transmission consisted of a pulley, ten shafts, ten pairs of gears (spurs, bevels and helicals) and a screw. The screw was 2 inches in diameter and ¼-inch pitch. Each end thrust was provided with a ball bearing, the arrangement being shown diagrammatically in the accompanying cut.

The coefficients used gave efficiencies of 0.97, 0.85 and 0.3 for the spurs and bevels, the helicals, and the screw, respectively, each including journal friction. It is obvious that if the efficiency at the second shaft is 0.97, that at the third shaft is 0.97^2, at the fourth shaft 0.97^3 and so on, the total efficiency of the arrangement being $0.97^6 \times 0.85^4 \times 0.3 = 0.13$, which is the product of the efficiencies of six pairs of spurs and bevels, four pairs of helicals and the screw, from which we get the startling result that nearly seven-eighths of the power put in is wasted. The efficiency at each shaft is indicated in the diagram and though helicals are made with efficiencies as high as 0.98, this excellence is not realized under ordinary conditions.

It is instructive to note the difference in the efficiency if such a transmission had been designed with spurs and bevels, instead of helicals, and the screw say of one pitch, assuming that the necessary relative speeds of pulley and screw could have been obtained with the same number of shafts and gears. The screw efficiency is here 0.62 and the total efficiency then is equal to $0.97^{10} \times 0.62 = 0.46$; that is, there is more than three times the useful power available than from the original arrangement.

Conditions of space available, compactness and speed reduction often force designers to use "slow" angle helicals and screws; though if maximum efficiency is desired, we should try to do without them altogether, or if this is impossible, then make them of comparatively "quick" lead.

A point in favor of helicals is the fact that it is possible to connect shafts up whose axes are in different planes with one pair of gears, which means an economy of parts over alternative arrangements of spurs and bevels, but I am inclined to think that the use of them will be very limited in the highly efficient machine of the future. Helicals on parallel shafts are, of course, not included in any of these remarks.

Other important points for maximum efficiency are the necessity for the absolute minimum number of parts that transmit power and the liberal use of ball or roller bearings for thrusts and journals. And it may be mentioned that in such a transmission as above, it would be incorrect to design the gears or other parts with regard to strength, at one end for the same horsepower as for those at the other. In this particular case nearly eight times more horsepower is transmitted by the first pair of gears than by the screw.

A Patent That Didn't Protect

By R. E. Marks

Patents are curious things and it isn't all the fault of the Patent Office either, however much that may have to answer for.

A certain firm had developed a machine, which we will call a hash mixer because that wasn't it at all, and had covered it with patents till it almost became a penal offense to eat hash that had not been prepared by the aforesaid Great Western machine. They had conquered the hash-mixing world, and they proposed to hold it fast for 17 years or know the reason why.

This hash mixer had been so successful in one of Uncle Sam's big hasheries, where the men waxed fat and ate hash eight days a week without a murmur, that no other brand was given any consideration. So, when the next lot of hash mixers were to be bought, the specifications were carefully drawn so that only the Great Western could fill the bill; as is often done.

And the Great Western people chuckled a long, deep chuckle, put in their bid at a price that left a fair margin of profit and then some, and prepared to reap the harvest of their ingenuity as specified by the patent situation.

But the chuckle petered out into a gasp or even a gurgle of surprise when they were informed by the secretary of the Department of Hasheries, that the contract for hash mixers had been awarded to the lowest bidder, the Oliver Cromwell hash mixer, as required by law.

When the Great Western manager had recovered his breath, pinched himself three times and otherwise convinced himself that it wasn't all a horrible nightmare, he instructed the attorney to threaten suit for patent infringement by wire or long distance 'phone, any way to get it done quickly. And then, when the other fellow came back with the suggestion that he could start suit any minute he chose, but that it would be a heap better to come and see him if he wanted to sell any hash mixers at all in future, he was so completely flabbergasted that he took the next train with only a collar button for baggage.

And then the Oliver Cromwell manager proved that he wasn't a hog at all, but that he was perfectly willing to give the Great Western hash mixer a show for his white alley in return for the pioneer work it had done.

After the ice had thawed a little so the Great Western man could smile without cracking his face, his opponent unburdening himself thusly:

"You had us beaten to a frazzle on the hash-mixer game, so that we were not in it for a minute on those Uncle Sam hash houses. But one day, one of our men was nosing around Manayunk and found a hash mixer that an old Dutchman had fudged up out of a sewing machine, a lawn mower and a corkscrew, that covered every point in your patents. He had built it so long ago that he had forgotten the date. Our man bought it and it's in the next room.

"Now I'm willing to play fair with you, for you deserve something for your patent and I realize that this was an accidental find on our part. I'll say nothing about this machine and divide the business with you at the price I've bid on the contract. We'll each build half the machines. You can give me a license to build under your patent and no one will be the wiser.

"If you sue for infringement, I'll trot out the old machine and that'll let the bars down for everyone, as your patents can't hold. Is it a go?"

And of course it was. There wasn't anything else to do, and they are still splitting orders on the hash mixers to the chagrin of the Great Western, but to the benefit of their mutual bank accounts.

It's a case where probably no patent system would have prevented the patents being issued, and when the invention was just as clear as in any patent I know of.

Accurate Operations on the Planer

Editorial Correspondence

Producing straight, square lengths of steel, with surfaces so accurate as to require no fitting, employing a simple fixture for holding the work and a device for relieving the tool on the back stroke.

Form-planing processes and attachments, and a method of setting the tool for cutting a locating slot in a driller column.

Cutting racks with an attachment mounted on the cross rail.

The high-grade planing done by the Sigourney Tool Company, Hartford, Conn., is a feature of interest to all visitors. This company makes a practice of planing many cast-iron and steel parts to such a degree of accuracy that no hand fitting or finishing whatsoever of bearing surfaces is required in the process of assembling.

A number of elements enter into the accomplishment of such results: The planers are kept level, square and in good condition generally; provision is made for lifting the tool on the return stroke to prevent rubbing off of the point; tool settings are facilitated by micrometer dials on all feed screws; the planer hands are men of skill and experience in this branch of work; and they work under the supervision of a foreman who has devoted practically an entire lifetime to the study and operation of the planer and who is therefore thoroughly conversant with the possibilities of that tool.

A number of interesting methods and special appliances in use in the planer department, are illustrated by the accompanying engravings.

A Fixture for Key Stock

The view in Fig. 1 represents a method of planing key stock on a fixture which is adapted also for holding other flat pieces such as gibs, straps, rack blanks, etc. The fixture has a series of steps of varying hights to accommodate different thicknesses of stock and along one edge there are a series of closely spaced holes for the reception of the bunter-screw plugs. These, where small stock is to be held, are placed in each hole so that the work is gripped along nearly its entire edge, as indicated in the halftone.

Black stock is used for key lengths and is cut about 12 or 15 inches long. This black machine steel has been found less inclined to spring and twist than cold-rolled material after the surface is removed, and following the roughing of the length it is finished with little difficulty to the exact size desired, perfectly straight and with a dead smooth surface, lard oil being used for all finish cuts on steel.

Practice As to Sizes

The key stock is planed 0.0005 inch thicker than standard one way, and exactly to standard the other. All keyways are cut with a tool finished exactly to standard width but there is always a possibility that in cutting say a dozen keyways with the same tool, one of them may be a trifle full, owing to a lack of uniformity in the cast iron, and in such cases the key can be put in the widest way, the extra half-thousandth compensating for the oversize of the keyway.

The photograph, Fig. 1, shows that a diamond-point tool is used and this is the form of tool employed throughout the

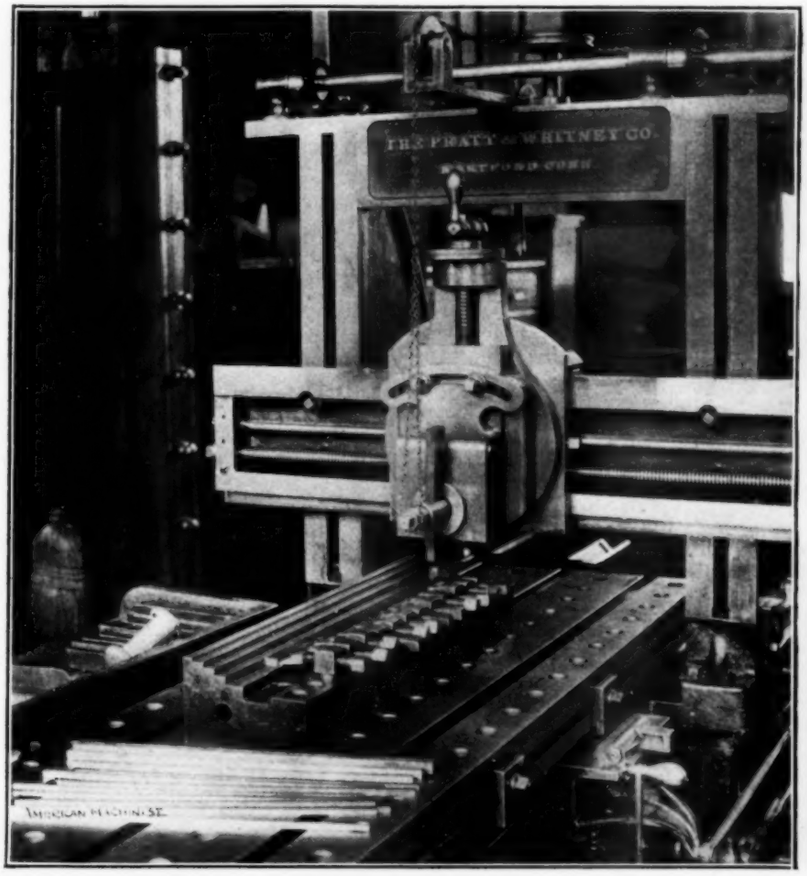
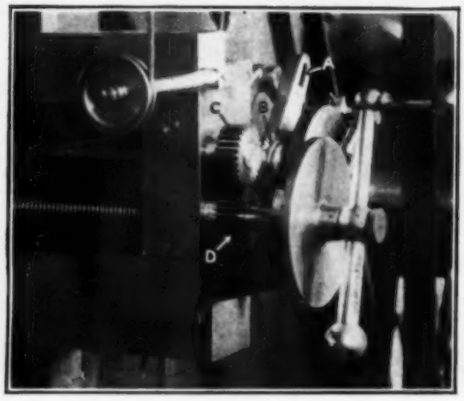


Fig. 1. Planing Keystock



Figs. 2 and 3. Feed Gear and Dial

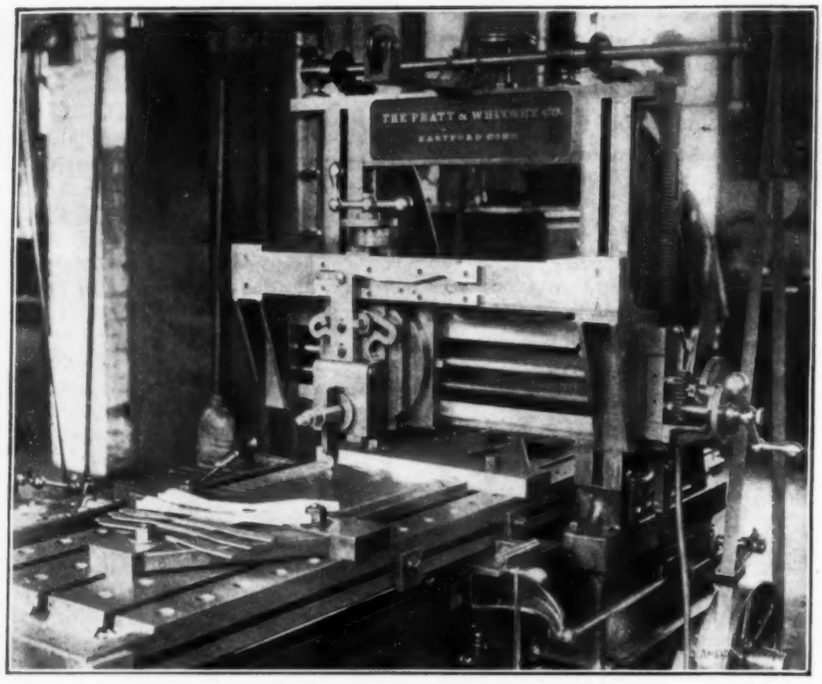


FIG. 4. FORM PLANING

department. The tools are made of carbon stock.

For finishing cuts on steel from two to five thousandths of an inch is left, and a correspondingly fine rate of feed is used. The setting of the tool for final cuts is accomplished with accuracy by means of size blocks and the micrometer dial on the feed screw.

THE TOOL LIFT

An important factor in the production of the smooth, true surfaces on this work is the provision for lifting the tool point clear of the metal for the return stroke. All rubbing and crumbling tendencies are avoided with this arrangement and once the tool point is properly stoned it will give satisfactory results for a considerable length of time.

The device consists simply of a light chain looped around the tool post and passing up over small shive wheels at the top of the planer, thence to the vertical feed rack to which the chain end is attached so that as the rack descends it lifts the tool, and upon its up stroke allows the tool to swing down to cutting position as the platen starts forward.

THE FEED SCREW DIALS

Large dials are fitted to all of the planer feed screws, both cross and vertical, and these dials are graduated to read to one-half thousandth. They are so mounted as to be readily adjusted to permit of initial settings to zero or any other desired graduation, and this feature will be best seen by referring to Figs. 2 and 3, which represent the end of the cross rail of a larger size of planer.

The graduated dial in the Sigourney system is placed a running fit on the end of the feed screw and its clamping device consists of a nurled-head thumb screw tapped into the end of the feed screw and pressing with its point against a wedge which acts in turn between a pair of shoes which are thus forced outwardly into contact with the interior of

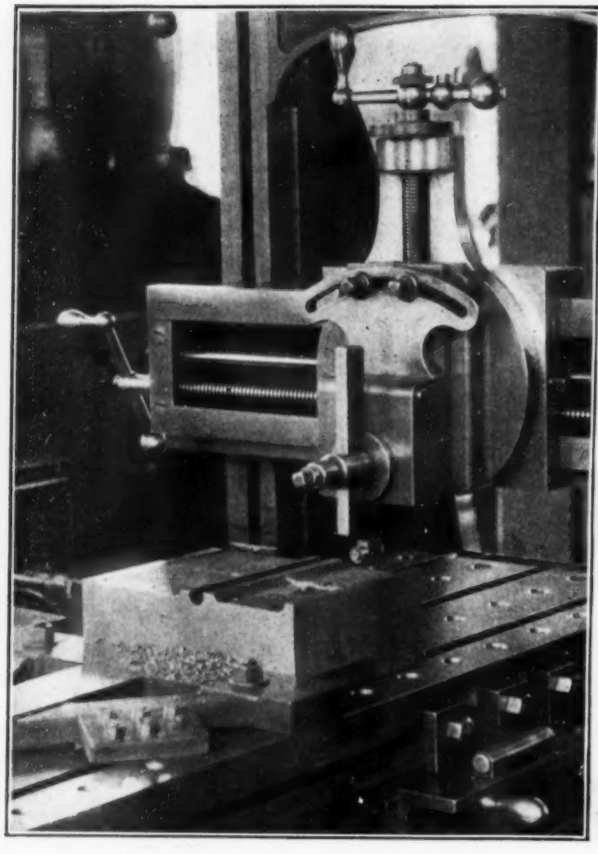


FIG. 5. PLANING A CIRCULAR SEAT

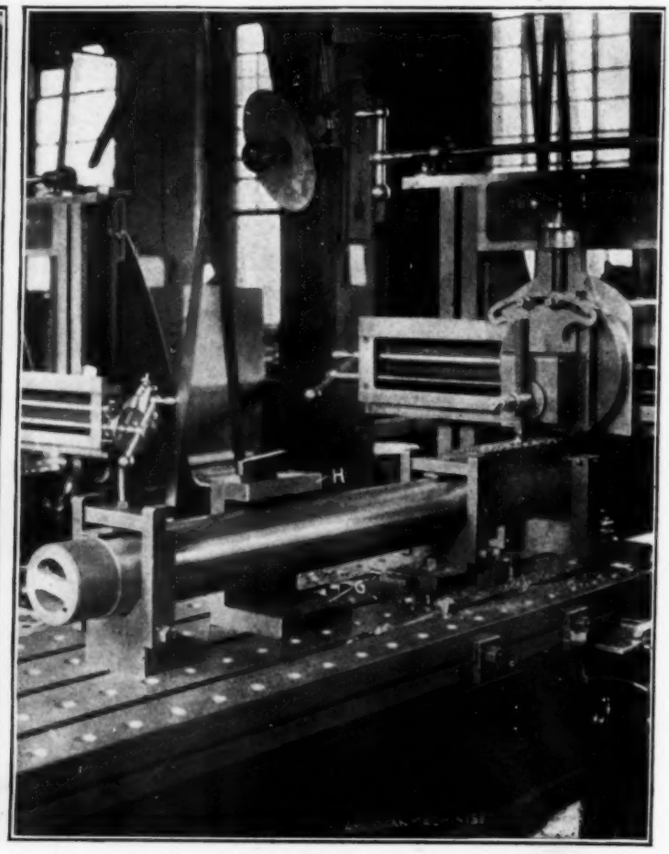


FIG. 6. OPERATIONS ON A DRILLER COLUMN

the hub of the dial. When the thumb screw is turned backward, the wedge releases the two shoes and the dial is free for re-adjustment.

The Feed Shift

Figs. 2 and 3 also show the device applied by the company to all of its planers for shifting the feed gear drive from the cross screw to the rod for the vertical screw, or *vice versa*. With the arrangement illustrated, the plate *A* carrying the tumbler gear *B* is swung up or down to engage the gear with either of the feed gears *C* or *D*, or to set it in neutral position by the handle *E* which carries a pin engaging in the slot in *A*. The relative locations of this pin and the pivot of the tumbler plate *A* are such that with the tumbler gear engaged with either gear *C* or *D*, the shifting handle is exactly in "dead center" position and the feed gear cannot be jarred out of its position or accidentally engaged with the wrong gear *C* or *D*.

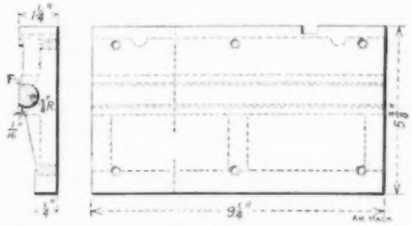


FIG. 7. A SWIVEL PLATE WITH A CYLINDRICAL SEAT PLANED IN THE FACE

Form Planing

A number of form-planing operations are regularly performed with the aid of cams mounted above the cross rail as shown by Fig. 4, where as will be noticed, the cam plates are carried by a heavy bar fitted in brackets which slip over the ends of the rail. The feed nut is loosened in the tool slide and the clapper box provided with a short arm carrying at its upper end a hardened roll which fits in the guide groove formed between the two cam plates. Lateral movement of the saddle produces simultaneously a vertical movement of the tool corresponding to the rises in the cam channel.

The thin levers on the platen which require planing to form are held, a large number at a time, between the parallel stops as shown. These are tongued to fit slots in the platen, and the faces between which the thin work strips are held are perfectly square with the tongued surfaces and exactly parallel with each other, so that the work has no freedom at either end to enable it to spring up under the action of the cut.

Planing a Circular Opening

Two other interesting planing operations are represented by Figs. 5 and 6. The first of these shows the application of a circular form tool to the finishing of a rocker seat in a cast-iron block. A similar piece is seen in the drawing, Fig. 7, which gives a few general dimensions.

This casting is a "face-plate swivel" for a book-trimming machine, and the cylindrical seat in its face receives a ¾-inch shaft, which is flattened on one side as at *F*, to permit a flat plate to be attached thereto. The clearance between the swivel block and the plate allows the latter to rock through an angle of a few degrees when the trimming machine is in operation, and it is the planing of the seat for the ¾ rock shaft *F* that calls into service the set of circular tools in Fig. 5.

In the first place, after the block has been planed square all over, a square-point tool is run down to rough out the channel across the top of the block and produce an opening wide enough to clear the holder which carries the circular tools. Five of these tools are then run through in succession cutting diameters as follows: 0.715-, 730-, 740-, 745,- 750-inch.

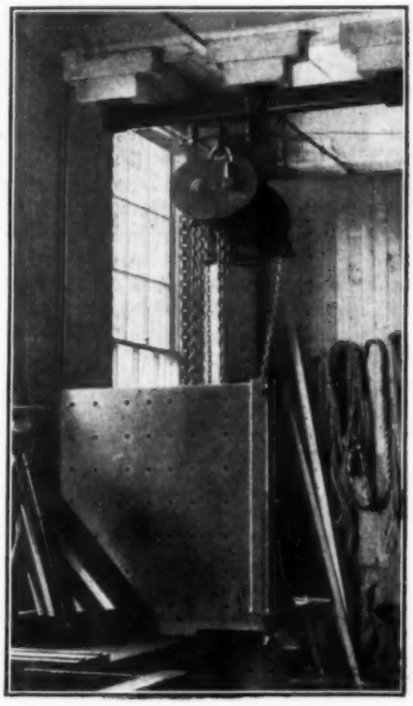


FIG. 9. METHOD OF GUARDING AND HANDLING AN ANGLE PLATE

The block on which the tools are placed when not in service is shown in the foreground of Fig. 5. It carries in addition to the five cutters, a disk gage exactly ¾ inch in diameter to test the accuracy of the planed seat.

A Driller-column Operation

Returning to Fig. 6, some tools for planing the flat side of a sensitive driller column are shown in use. The work is secured in V-blocks, which are tongued for alinement on the table and which are provided with quick-acting clamps at the top. The side thrust opposite the portion to be planed to receive the spindle head is taken by jack screws in the uprights of the supporting block at the upper end of the column.

The block at *G* serves as a gage for facilitating the setting of the tool. After the straight face has been planed off to hight, a square-nose tool is used for cutting a slot central with the column to locate the spindle head correctly when the driller is assembled; the head itself having a tongue which is planed exactly central with the spindle bearings.

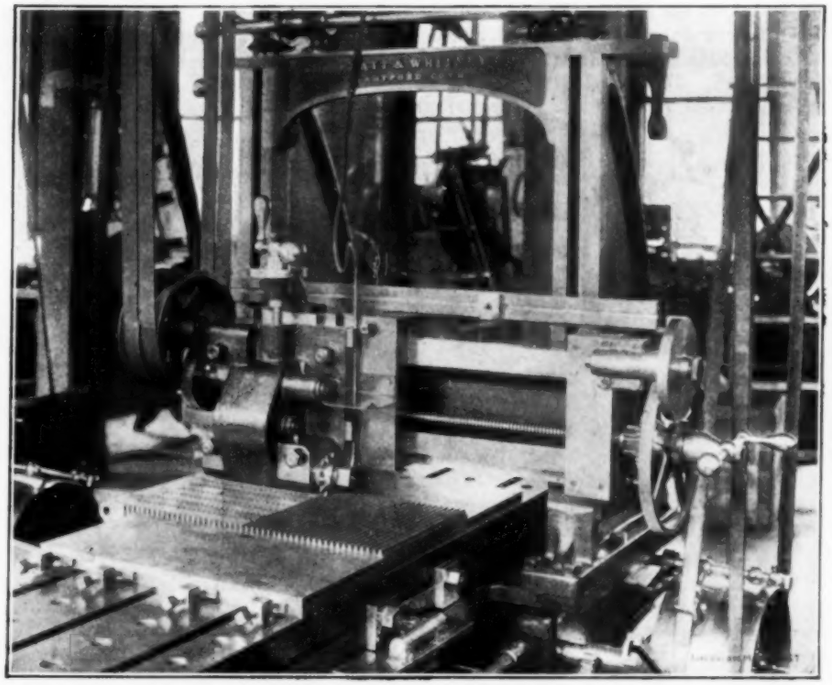


FIG. 8. RACK-CUTTING ATTACHMENT

The position of the square-point tool is determined accurately by the face *H* of gage *G*. The gage block is brought against the side of the cylindrical column and a size block for a certain thickness is placed against face *H*. The planer head is then adjusted until the square point just touches the side of the size block, which in this case is used as a feeler, and the tool is thus brought central for the slot-cutting operation.

The Planer as a Rack Cutter

An attachment that converts the planer into a rack cutter, is illustrated in Fig. 8. This firm makes many racks which are cut on two sides as in the engraving, as well as the usual single form of rack. With both classes of racks and whether of steel or cast iron, accuracy of pitch is important and the location of the teeth from the ends of the racks must be exactly the same in all cases. The racks are used in pairs in book-binding machinery and interchangeability must be absolutely assured in order that a rack may be sent from the plant at any time to replace one taken from a machine, and work properly with the remaining rack of the original pair.

Holding the Work

The rack blanks are placed several at a time between the two broad clamp plates, which, by the way, test the parallelism and squareness of the work, for any error in the planing will be revealed at once when the attempt is made to hold six or eight pieces side by side between the two rigid parallel plates. The blanks are pressed against an end stop, which always has a certain position on the planer and the saddle with the cutter slide is located for the first tooth by a line on the upper face of the saddle, which is brought into coincidence with a line on the gage block shown attached to the narrow rail above the regular cross rail.

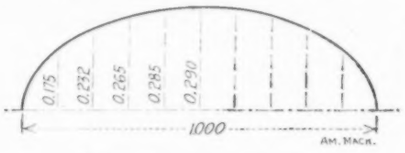
The spacing for succeeding teeth is secured by aid of the graduated dial, which reads to 0.0001 inch. When the racks are of cast iron, one cut only is taken for each tooth. On steel racks two cuts are taken. The cutter is kept free from chips by an air blast, the pipe for which will be noticed directly behind the cutter arbor.

Care of Appliances

Naturally, such important tools as squares, parallels, angle plates, knees, etc., are taken good care of in the planer department, and an indication of this is given in Fig. 9, which shows a large knee on the bench with the outer edge guarded by a wooden shield. This view also shows the trolley rail and hoist which enable a heavy fixture of this kind to be picked up by its eye bolt and run directly onto the planer table with little effort and without danger of injury.

The True Isometric Ellipse

In order to determine the points of the ellipse for free-hand isometric drawing, one uses ordinates or perpendiculars to the major axis, these having a certain given relation to the diameter of the circle which the ellipse represents These ordinates, see figure, are, with relation to the diameter of the circle, as follows:



True Isometric Ellipse

Diameter of circle, 1.000; major axis, 1.225; ordinates to five equal successive abscissas or sections of the half major axis, 0.212, 0.285, 0.325, 0.345, 0.352. The fifth ordinate is the half minor axis of the ellipse.

Where the major axis is taken as the base, 1.000, the five successive ordinates to equal abscissas are as follows: 0.175, 0.232, 0.265, 0.285 and 0.290.

An Arc Turning Rig

By H. Clayton

We had a large number of bronze castings of the shape shown at *X* to be turned. They had to be accurate and smooth. Milling was found to be unsatisfactory as they would spring out of shape and show cutter marks.

The oscillating attachment shown in the cut was finally made for a lathe which was usually idle.

The back-gear spindle and gears were removed and the shaft *A* substituted, with the gear *B* keyed on one end and a crank-arm keyed to the other.

This shaft *A* is bored and bronze bushed at the gear end to run on the stud *S*. The crank end runs in the bronze bushing *K*.

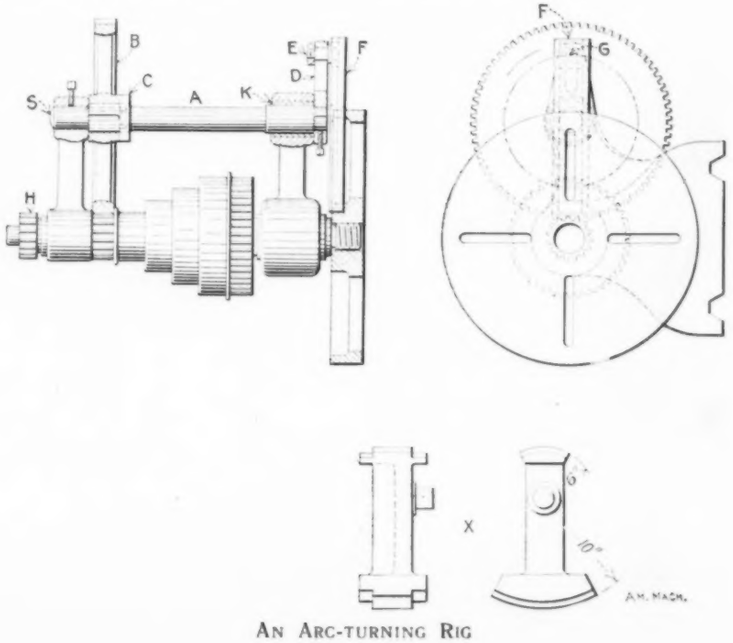
The device can be set for different length strokes or swings by resetting the stud *E* in the slotted crank arm *D*.

The driving arm *F* is bolted and doweled to the back of the faceplate, and has a groove cut its entire length for the sliding block *G* to work in. The stud *E* projects from the crank-arm into the sliding block *G* which is bushed to receive it.

The operation of this device is obvious, the cone pulley gear drives the shaft *A* through the gear *B*, the rotation of the crank-arm giving the faceplate a back and forth movement. An ordinary click feed was attached to the gear *H* and so arranged as to feed the lathe carriage forward just before the tool came in contact with the work.

The work was secured to the faceplate by a simple centering jig.

This device produced true cylindrical surfaces, which were required in this case, and has since been found useful on other work of similar character.



An Arc-turning Rig

In speaking of increasing efficiencies in workshops, a prominent shop manager says that manufacturers are just beginning to resolve into first principles the various manufacturing processes of their finished products. They have yet to apply this analysis in exactness to the problem of machine efficiency in the manufacture of their products. He stated that he believed that there is a lack of knowledge of the possibilities of the most common type of machine tools in every shop; in fact there is not one shop in 10 in which the possibilities of even the engine lathe are thoroughly understood.

Census of British Production

By I. W. Chubb

A good index to the work in the manufacturing industries.

A comparison of the values with the corresponding values for the preceding year shows accurately the increase of the various products.

There has been issued a complete set of preliminary tables resulting from returns made in connection with the first census of production in the United Kingdom of Great Britain and Ireland. The figures relate to the year 1907 and, although they admittedly need some slight revision, they are held officially to form a good index for the present to the work of the people of the country during the year named. A final report, now being prepared, will offer corrected tables and in addition will give some details of power used in factories. It should be explained that fundamental industries are concerned; that is, those connected with extracting and manufacturing processes. Transport and connective industries generally are omitted; in addition agriculture will be dealt with separately. The returns relate to mines and quarries, the metal trades, engineering and shipbuilding, chemical trades, brick, pottery, cement and glass making, paper and printing trades, textile, clothing and leather trades, food, drink and tobacco manufacture, building, woodworking and furnishing and public utility services.

These industries employ some 6,936,000 people, together with about 100,000 outworkers. Thus rather more than 7,000,000 people were employed on the work reported, and this may be compared with the estimated total of between 15,000,000 and 16,000,000 workpeople in Great Britain and Ireland.

	Gross Output		Materials Used, Cost		Work Given Out, Amount Paid to Other Firms		Net Output		Average Number of People Employed
	Millions		Millions		Millions		Millions		
	£	Dollars	£	Dollars	£	Dollars	£	Dollars	
England and Wales	1,483	7,415	860	4,300	20	100	603	3,015	5,764,000
Scotland	208	1,040	116	580	5	25	87	435	885,000
Ireland	66	330	43	215	1	5	22	110	287,000
United Kingdom	1,757	8,785	1,019	5,095	26	130	712	3,560	6,936,000

TABLE 1. CENSUS OF BRITISH PRODUCTION

The total production is given in Table 1, the first columns of figures giving gross output as selling value or value of work done, while the second sets of figures relate to cost of materials used, the third to work given out, showing the amount paid to outside firms, and the fourth set of figures gives the net output as calculated by subtracting the sum of the second and third sets of figures from the first set.

It is known that the figures relating to gross output and to materials include some amount of duplication, as the finished product of one factory may be merely material for another. But there is no duplication in the net output. Of course, the value of materials obtained outside the industries to which the returns refer must be added to the net output before the value of the output for consumption can be determined. The net output is in short the value of the work put into material in the industries concerned during the year 1907.

The figures for engineering products have been published for some little time, and it has been shown that, including shipbuilding yards and marine-engineering works, engineering factories of various kinds, mechanical and electrical, and cycle and motor factories, the net output for the year in these branches of industries was £72,502,000, or $362,510,000. Table 2 gives details, showing that in addition the net output of the government shipbuilding yards, etc., amounted to £2,489,068, or $12,445,340.

A somewhat surprising result is that the net output per person employed in shipbuilding yards is rather lower than that in government yards. The difference is accentuated when it is noted that, while the output of the private yards is on a profit basis, that of the government yards is on cost of production. It is also to be noted that the figures given for cycles and motors are not complete, part of this work being included under the more general heading.

Values of Engineering Productions

Taking now the values of finished engineering productions, according to classes manufactured during 1907 in the United Kingdom, the total for steam engines is £12,355,000, or $61,775,000. Internal-combustion engines, excluding those on motor vehicles, were valued at £1,838,000, or $9,190,000, and other prime movers at £956,000, or $4,780,000.

Machinery, excluding electrical but including boilers, is entered at £34,955,000, or $174,775,000; implements and tools, agricultural and otherwise, at £1,922,000, or $9,610,000; ordnance, excluding ammunition, torpedoes, etc., at £2,763,000, or $13,815,000; rail and tramroad iron and steel, carriages, wagons and parts, at £1,479,000, or $7,395,000; iron and steel structural work, £4,877,000, or $24,385,000; repair and jobbing work, £6,190,000, or $30,950,000; and work in progress, which could not be definitely allocated in classes, at £6,340,000, or $31,700,000. With other classes, the total for general engineering is £76,238,000, or $381,190,000.

Electrical Products

The total for electrical engineering is similarly £13,782,999, or $68,918,000. The classes include electrical machinery, such as generators and motors, transformers, converters, switches, etc., totaling £4,156,000, or $20,780,000; electrical instruments, £484,000, or $2,420,000; primary batteries, £109,000, or $545,000; secondary batteries, £434,000, or $2,170,000; lamps of various kinds, £461,000, or $2,305,000; telegraph cables, £1,911,000, or $9,555,000; electric power and lighting cables, £3,351,000, or $16,755,000; and contract work, £1,247,000, or $6,235,000. It would seem that about twice as much in the way of electrical motors is manufactured, as compared with generators, the figures being £1,592,000 and £851,000, respectively.

The total does not include the value of motor vehicles, cycles, etc., made in general engineering works as distinnt from motor and cycle factories. Excluded, too, are marine engines, etc., the heating, ventilating and sanitary engineering branches, and engineering work, including, of course, the production of locomotives, carried on by railway companies. The figures for implements and tools also show only the part of the trade that it carried on by engineering firms.

Machine Tools

Included in the total for value of machinery will be found £12,924,000, or $64,620,000 for textile machinery, and £2,715,000, or $13,575,000 for machine tools.

The latter were produced entirely in Great Britain, £2,306,000 worth in England and Wales, and £409,000 worth in Scotland. Details of weights were incomplete, but as regards £1,954,000 worth of the total production of machine tools the weight was 52,000 tons. Put shortly, excluding cycles and motor vehicles, the value of the total output of the British engineering industry in 1907 was estimated at between £90,000,000 and £100,000,000, that is, between $450,000,000 and $500,000,000.

Census Enables Accurate Measurement of Values

Apart from giving firm evidence for the future of British progress, or otherwise in manufacturing, the census of production, when compared with the corresponding annual statement of exports and imports, should enable the values of the home market in any particular branch of industry to be accurately measured. Unfortunately the production census for 1907 and the annual statement of trade were not made on the same lines, although this handicap will not exist for the future. Taking values as far as they are truly comparable, it is shown that the total production of steam engines in 1907 was valued at £12,355,000, while exports were at £7,900,000, or $61,775,000 and $39,500,000, respectively. The net imports, that is imports less exports, amounted only to £74,153.

The engines were of all descriptions, but excluded locomotives made by railway companies. In machinery, including agriculture, mining, textile and also internal combustion, hydraulic and other prime movers, the production was valued at £37,749,000 ($188,745,000), with exports at £22,848,999 ($114,240,000), and net imports at £3,235,000 ($16,175,000). In electrical-machinery apparatus, cables, etc., production was valued at £12,144,000 ($60,720,000), exports at £3,466,000 ($17,330,000), and net imports at £1,651,000 ($8,255,000).

Values per Ton

It is pointed out that the value per ton of the machinery exported is considerably higher than the average value per ton retained by manufacturers. Exporters declare the value of goods on board at port of shipment, importers at port of landing, while the census figures are values at works. Nevertheless it is considered that weight values of engines and machinery exported must have been higher than those retained. For instance, in textile machinery the value at the works was about £33 a ton, while the average value of textile machinery exported was £44 a ton, free on board.

Imports of steam engines hardly count; those of machinery other than electrical were about 9 per cent. of the total production of the United Kingdom; of electrical machinery nearly 14 per cent.; of electrical apparatus and goods 26 per cent.; telegraph and telephone cables 11 per cent.; and of other electrical wires and cables 10 per cent.

As far as these returns are concerned, persons employed in the engineering industry numbered 455,561, of whom 38,637 were salaried and 416,924 were wage earners. In the total, too, were 16,675 females, about one-third of them being under 18 years of age. Of males 63,293 were under 18.

Finally, a note may be added on British electrical undertakings. Returns showed that companies and public authorities generated 1,430,069,000 board of trade units; that is, kilowatt-hours. This excludes private generating plant used by industrial and commercial establishments and by railway and tramway companies. The railway companies generated 174,607,000 units, and tramway and light railway companies 54,743,000 units. The net output, representing the amount by which the outputs exceeded cost of material and of electricity used or purchased in bulk by authorized distributors, was £5,568,000, the cost of materials being about £3,000,000, and of electricity purchased in bulk about £335,000.

Although returns on the point were not compulsory, an attempt was made to determine loss in transmission. Calculating on difference between units supplied and units generated, transmission losses amounted in one group of companies to about 8.1 per cent., in another group of companies to about 10.3 per cent., in a group of local authorities to about 9 per cent., and in another group to about 9.6 per cent. The average number of persons employed in connection with electricity undertakings on the four days selected for the return was 22,618, that is, 18,826 wage earners and 3947 salaried persons.

[It will be obvious that in this article the dollar is taken as equal to one-fifth of the sovereign and that as a rule the figures are true to the nearest £1000 only.—Editor]

	Gross Output		Materials Used, Cost		Work Given Out		Net Output		Persons Employed, Total	Net Output Per Person Employed	
	£	Dollars	£	Dollars	£	Dollars	£	Dollars		£	Dollars
Shipbuilding yards and marine engineering works—private firms.	41,660,000	208,300,000	17,895,000	89,475,000	6,087,000	30,435,000	17,678,000	88,390,000	184,557	96	480
Engineering factories (including electrical engineering)	101,599,000	507,995,000	48,323,000	241,615,000	3,851,000	19,255,000	49,425,000	247,125,000	455,561	108	540
Cycle and motor factories	10,643,000	53,215,000	5,063,000	25,315,000	181,000	905,000	5,399,000	26,995,000	46,800	115	575
Total	153,902,000	769,510,000	71,281,000	356,405,000	10,119,000	50,595,000	72,502,000	362,510,000	686,918	—	—
Shipbuilding—government yards and lighthouse authorities	6,450,480	32,252,400	3,961,412	19,807,060	—	—	2,489,068	12,445,340	25,058	99	495

TABLE II. CENSUS OF BRITISH PRODUCTION

Pulley Faces and Belt Speeds for Medium Speed Motors

By H. M. Nichols

The accompanying table gives the belt widths and speeds and the corresponding pulley-face widths that are usually employed for motors running at medium speeds.

PULLEY FACES AND BELT SPEEDS FOR MEDIUM SPEED MOTORS

Horsepower	Width Belt	Pulley Face	Belt Speed in Feet per Minute
1 to 4	2″	2½″	2000
5 to 10	3″	3½″	2500
10 to 15	4″	4½″	2500
15 to 20	5″	6″	2500 to 3000
20 to 25	6″	7″	3000
30 to 40	8″	9″	3000
40 to 50	10″	11″	3000
50 to 60	12″	13″	3000 to 3500
60 to 75	14″	15″	3500
75 to 100	16″	17″	3500 to 4000
100 to 125	16″	17″	4000
125 to 150	18″	19″	4000 to 4500
150 to 200	20″	21″	4500

A locomotive of 1000 horsepower driven by a Diesel engine has just been set to work on the Prussian State Railways. The drive is direct to the axles, and the outward appearance is similar to that of an electric locomotive. Nearly $60,000 have been spent in experimenting with this engine.

An Automatic Rack Cutter and Miller

By Ethan Viall*

A machine of unusual design for cutting racks with standard involute teeth, which may also be used for other milling work.

The way the indexing of the head and the feeding and reversing movements of the spindle are obtained.

*Associate editor.

A traveling head machine built by The Brown Cotton Gin Company, New London, Conn., for automatically milling and cutting printing-press racks or other work, has a number of mechanical features worth noticing.

Fig. 1 is a back view of the machine with a press rack in place, and gives a good idea of the traveling head, while Fig. 2 shows the opposite end.

The rack teeth are standard involute and are milled on both sides; hence the fixture at *A* is used to tilt the rack to the proper angle for milling and cutting the teeth, one side being finished. The rack is then turned end for end and the other side cut.

It will be noticed that there are two lead screws at *B* and *C*, one of which is used for indexing only and so is subject to a minimum of wear, all feeding that would otherwise be done with it being done with the other.

All driving is done primarily from the shaft *D* run by pulley *E*. This shaft is splined, and a keyed and bracketed bevel gear runs on it, which meshes with gear *F* and drives the traveling-head mechanism. All working parts subject to dirt or liable to catch anything are covered and any parts shown exposed have been uncovered in order to show the mechanism to better advantage.

Fig. 3 shows the cutter *A* just feeding in at the beginning of a cut, the cutter being fed in to the proper depth; then downward to the opposite end of the slot; then backed out; raised to the top; indexed to the next slot and again fed in and so on, all the operations, of course, being automatic. At *B* is the cam which feeds the cutter spindle in or out and *C* is the indexing trip. The handwheel *D* is used to feed the spindle out or in by hand while setting the machine for depth of cut. Fig. 4 shows the cutter at the lower end of slot and the cams in a different position.

The length of up or down feed is regulated by the stops *A* and *B*, Fig. 5, which trip the clutch and reverse lever *C*. This halftone shows the head feeding down shortly after the reverse clutch has been thrown. Fig. 6 shows the clutch tripped and the head just ready to feed up again.

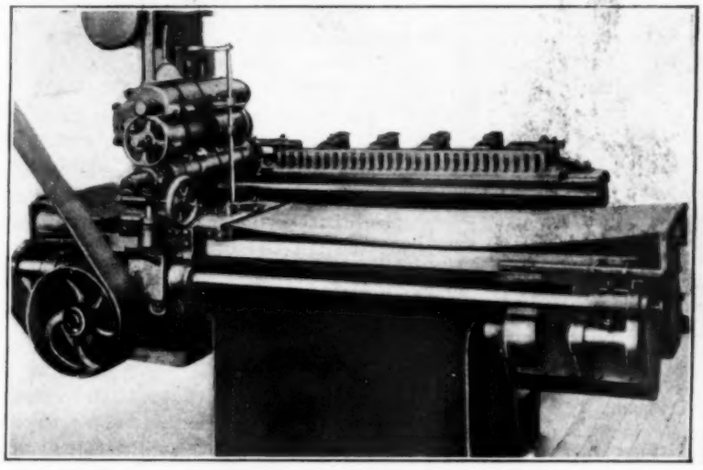


FIG. 1. BACK VIEW OF RACK CUTTER AND MILLER

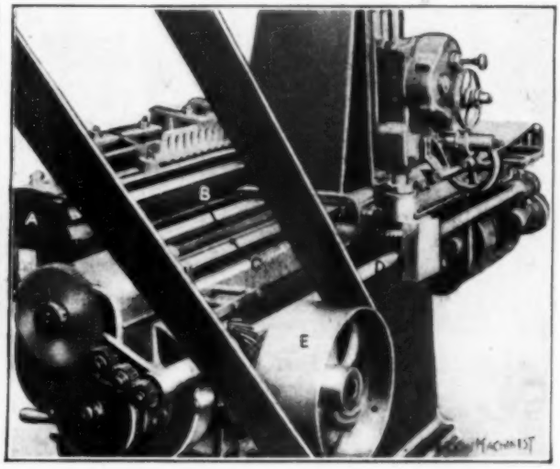


FIG. 2. LEAD SCREWS AND RACK-HOLDING FIXTURE

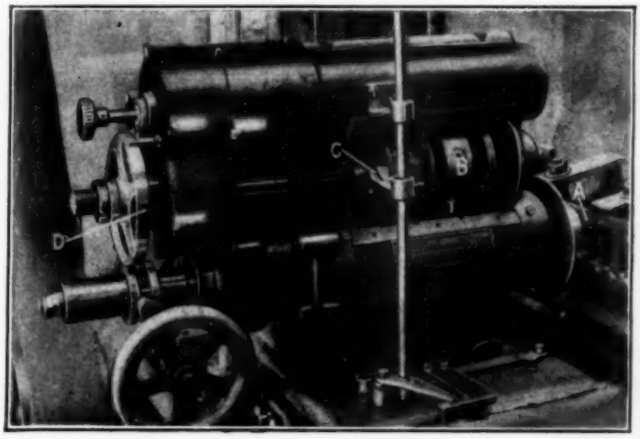


FIG. 3. CUTTER AT TOP OF SLOT

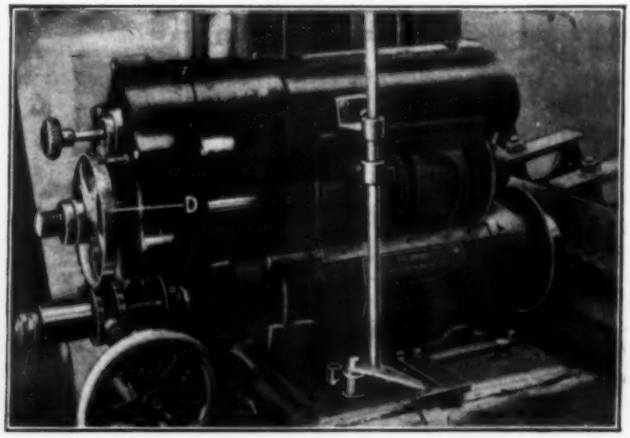


FIG. 4. CUTTER AT BOTTOM OF SLOT

In a New Orleans Repair Shop

Editorial Correspondence

Some of the problems which confront a shop in such a city as New Orleans and the way in which they are handled.

The machine shop of the Far South is of necessity a repairing rather than a manufacturing proposition in nearly all cases. In the Johnson Iron Works in New Orleans, La., the work is very largely river steamboat repairs, although there are more different kind of jobs drifting into such a place than you might imagine.

In one case they secured a contract for a lot of coining presses for the Chinese government and carried it through successfully, the only other bidder being a well known firm in the North who make a specialty of such equipment. All of which goes to show that there are still many places where the all-around machinist is a necessity and where the specialist would be all at sea. There are more such places than those of us who only think of the large manufacturing shops realize.

One relic of this contract which I found was an indicating gage as shown in Fig. 1. This was made from a large steam gage, a heavy cast-iron base for stability and the multiplying bell-crank lever *A*, which was supported by the arm *B*, fastened to the case and connected to the movement of the gage. This connection, with the various combinations of levers, pinions and gears, figured out to give an indication of 0.007 inch for every mark on the dial of the gage.

This was made for gaging the sizes of the punches used and was found very useful in securing accurately fitting punches, dies and other parts. It has the advantage of being very easily read, even at a distance.

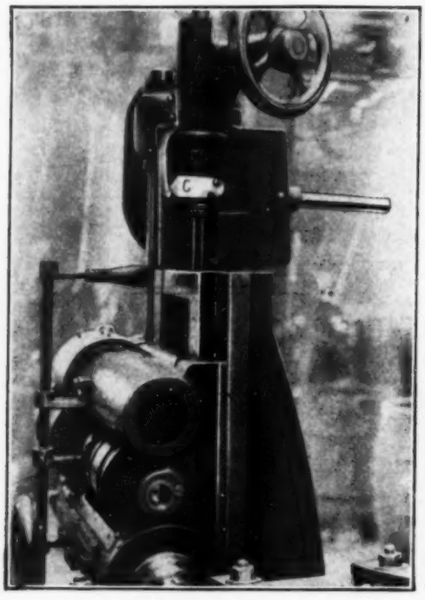


FIG. 5. VERTICAL FEED REVERSE

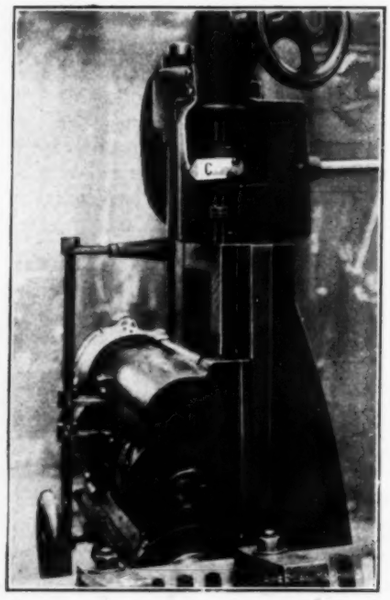


FIG. 6. READY TO FEED UP

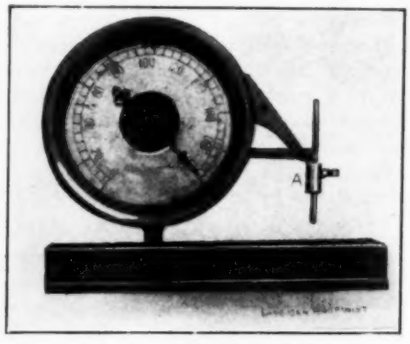


FIG. 1. A LARGE INDICATING GAGE

A MISSISSIPPI STEAMER CYLINDER

Those who are not familiar with the type of engine used on the Mississippi and other western river steamboats, would hardly recognize a cylinder casting if they saw it and one cannot help calling to mind the old nicknames of "gun barrels" or referring to them as having "six months stroke."

The cylinder shown in Figs. 2 and 3 is 18½-inch bore and is 111 inches long, not an easy thing to bore. In fact, as can be seen, this particular job is tying up two machines, the horizontal boring machine, the planer which is supporting most of the cylinder and is even borrowing the tail end of a lathe bed to support the feeding mechanism of the boring bar.

This feeding scheme is a variation of the star feed which is not usually found. The usual "star" wheel is replaced by a pinion having about 16 teeth and in place of the pin is a gear wheel simply bolted to an angle plate fixed on the foot of the lathe so as to bring it in the proper position.

BANDING A CRACKED WHEEL HUB

As an example of the character of the work which comes to a shop of this kind,

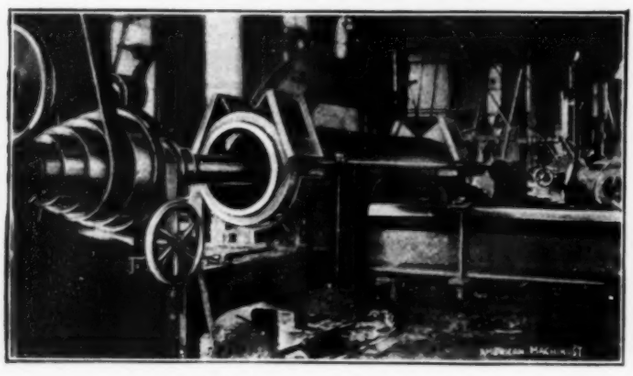


FIG. 2. BORING A 9-FOOT CYLINDER

FIG. 3. THE FEED GEARING ON THE BAR

I must mention an air-compressor repair that was going through at the time of my visit. This compressor had a pair of fairly heavy flywheels with rather light hubs.

These had been neglected and the key allowed to work loose in the keyway until it was "chewed" very badly and the wheel finally dropped off the shaft, after cracking out a piece of the hub over the keyway.

A new keyway had to be planed in the shaft and a heavy band shrunk over the hub to draw the piece back into place and hold it—although the new keyway was located on the quarter. This band was entirely a blacksmith's job, being welded up to the right size so as to just slip over the hub when hot and clamp it tightly when cooled. The ring had just been slipped over and was being cooled when I saw it and, after it was cold, it was apparently as good a job as though it had been bored out. It fitted splendidly and a hammer test showed a good bearing all around.

After this the hub was to be bored out enough to admit a bushing made of half-inch boiler plate rolled up into a cylinder, an opening making the keyway after being bored out to size for the shaft.

I am indebted to both Mr. Johnson and the superintendent, George Koffskey, for the opportunity which they cordially afforded for securing this information and these illustrations.

Catalog Conservation

An English firm sends with its catalog a slip with the following printed thereon:

"We do not hesitate to send you this catalog for the asking, and will cheerfully send you more if you want them, but if you find it is not exactly what you expected and have no use for it, please pass it to some machinist or factory superintendent, or return it to us by mail, and we will reimburse you for the postage."

Record of Williamson School Graduates

The class graduating from the Williamson Free School of Mechanical Trades, Delaware county, Penn., on March 25, 1911, consisting of 65 members, had made the following record by September 1:

Trade	Average Weekly Rate of Compensation
Bricklayers	$18.00
Carpenters	15.51
Engineers	14.44
Machinists	15.42
Patternmakers	14.51

This is a general average of $15.57, five months after graduation.

The same class of the previous year were earning an average of $16.60 after the same period, and by September 1, 1911, were earning an average of $18.05 a week, a gain of 9 per cent. in one year.

The Basis of Proper Management*

By H. L. Gantt†

The basis of proper management is task work.

But the problem of establishing an order of work and increasing the general shop efficiency should be first solved. Then take up the efficiency of the individual.

*Excerpt from address given at the convention of National Association of Machine Tool Builders.

†Consulting engineer, Singer building, New York City.

Scheduling Miscellaneous Work

Where the work is miscellaneous in character, the task of having each part go through the proper sequence of operations and arrive at the erecting shop in the order wanted is not easy. As a matter of fact, it is my feeling that the inability to get miscellaneous work through a shop on time and the delays caused thereby, are often the source of as much expense as inefficient work on the part of the operative.

In a small shop one capable man can often plan and mentally keep track of miscellaneous work, so that but little expense is incurred from delays or interferences. But in the large shops of today, especially in plants consisting of several shops, such a thing is quite impossible; and the larger the shop or plant the greater the expense that arises from this source. This, then, is the greatest and most important task to be performed in any works, and it is one for which the management is solely responsible.

When a start has been made, and each foreman receives each day a list of jobs to be done that day, the general efficiency of the works is much increased, though nothing whatever has been done to increase the efficiency of the individual workman. Although such an order of work is of great assistance to the foreman, its usefulness increases rapidly as the work is planned to avoid interferences and to have all material and appliances ready for each workman in advance. With the accomplishment of this result the efficiency of the individual naturally increases. But unless the inefficiency of the individual is very flagrant, it is far better to solve this general problem first and not take up the efficiency of the workman until later, except to the extent of keeping a daily record of his work. When the large problem is solved, every step in advance made with the individual counts for all it is worth, which is not always the case when work is done in the wrong sequence or by an inferior method.

Having solved our large problem of scheduling each part through the works, and devised means for knowing each day whether our schedules are lived up to or not, we come to what most people consider the real problem, that of setting a task for the workman.

To send a clerk into a shop with a stop watch to time workmen and set rates, or tasks, naturally arouses the opposition of the workmen. While I have no doubt that it has been possible in many cases to get more work by so doing, I have no doubt also that its effect on the industrial conditions of the country at large has been decidedly detrimental.

Working at tasks is not a hardship but a pleasure, if they are properly set and the reward adequate. Before task setting can be carried on satisfactorily, the workmen must be convinced we are not approaching them with a scheme for driving, but with one by which they will be benefited.

Preparation for Task Setting

Among the steps to be taken before attempting to set a task are: Get all machines and appliances in proper order; establish a proper tool room where suitable tools can be obtained for work; arrange to supply the workmen with material in the order wanted; plan the work so that it is very seldom that one job will be stopped to make way for another. In other words, before we begin the subject of task setting for the individual, we should arrange conditions so that he can work to the best advantage, which also include proper ventilation and a comfortable temperature. These conditions alone will materially increase his output, for petty annoyances of any kind reduce his efficiency. If the work requires mechanical skill or ability, the problem should be studied by the most capable mechanic available, and specific instructions set showing the best way to do the work and the time needed when it is done that way. If necessary, and it usually is, the investigator and task setter should now turn instructor and show the workmen how to do the work. The task should be such that a good workman can readily learn to perform it. With the task set in

this manner by a man in whose ability and honesty the workman has confidence, I have had little difficulty in getting task work started, provided a proper bonus was also affered.

This leads to the question as to what a proper bonus is. The reply is, that it is such a bonus as will make the workmen feel that he is fully compensated for the extra exertion he puts forth.

Judged from this point of view, it is evident that the bonus depends upon the severity of the work. It varies as a rule from 20 to 50 per cent. of the day rate. Task work does not necessarily mean more severe work, but it does mean more continuous work; work under more favorable conditions which always produce greater efficiency.

The attempt to set a task so severe that very few people can be taught to perform it is of no advantage from any standpoint, for few will continue to strive for a reward which they cannot reach.

Performing the Task

Having set a task, the responsibility for its performance does not rest upon the workman alone, but must be shared by the instructor, who must see that the conditions under which the task was set are maintained. To complete the scheme, therefore, every case of lost bonus must be investigated and the reason determined. Such investigations, when the case is that of a man who has learned the work, usually lead to the discovery of slightly defective material, imperfect tools, machine out of order, or any one of a larger number of things that might hamper the output by 10 or 15 per cent., but which would not be noticed unless a special search was made for them. Thus the setting of a proper task for a workman also imposes obligations on, or sets a task for, the management, with the invariable result of a better and cheaper product.

Task Work in a Machine Shop

The setting of machine-shop tasks is today quite different from what it was 10 years ago. At that time machine operations took a relatively long time, and the time between operations was of much less importance. Today when machine operations are, as a rule, three times as fast the time of changing jobs has become three times as important; and to plan our work so that there will be no time lost in going from one job to another has become a far greater factor. For each machine-tool operative today, there has to be planned nearly three times as much work; necessarily the supervising force must be much greater. It is this increase in machine capacity which has induced me to lay emphasis on the general scheduling of work, so that no more time than necessary may be taken in changing jobs.

The ratio between the number of men actually engaged on mechanical work and those engaged in supervising or in preparing work, must necessarily be quite different from what it was before the advent of high-speed steel.

Task setting in every kind of shop is similar. Although we do not have high-speed steel to reduce time in non-metal-working shops, we have in many cases something else, the benefit of which is never fully realized until a proper and detailed study is made of its possibilities. We have found, that if work is properly planned so that no unnecessary delays occur and the workmen are provided with proper implements to enable them to perform their tasks in the best manner we can devise, as a rule wherever the amount of work depends upon physical exertion, they can do three times as much as they formerly did on day work and feel no more tired at night.

Miantaining Proper Conditions

While the setting of tasks under proper conditions and in the proper spirit, accompanied by the suitable reward for accomplishment, is of great advantage, it is essential that the conditions under which the tasks have been set should be maintained permanently. Failure to maintain these conditions will work a hardship on the workman and, many times, make it impossible for him to perform his task. No one should, therefore, undertake the introduction of task work unless he is prepared to maintain the conditions of his shop at a high standard; else dissatisfaction is sure to spring up.

The sum of the tasks which can be performed by the individuals of a shop is the shop task; the sum of the tasks of the shops the factory task. Every foreman who can succeed in the accomplishment of his shop task should be properly rewarded. In such a scheme as this the foreman and the workmen are brought together by mutual interest and there develops a spirit of coöperation.

Under such a scheme as described above it is perfectly evident that there will be a decided increase of profits.

Having satisfied ourselves that these methods, if properly applied, will result in an increased production of wealth, we must, before passing final judgment on the scheme, ask what effect this increase in wealth will have on the industrial conditions of the country.

Effect of "Scientific Management" on General Prosperity

General prosperity is not promoted by the accumulation of wealth in the hands of one class but by the interchange of commodities.

Unless, therefore, these methods help this interchange the community will be but slightly benefited. Individual concerns will undoubtedly be largely benefited at first, but it is doubtful if this benefit will continue unless the public at large is also benefited.

Adam Smith told us over a century ago, that prosperity was greatest when profits were small and business, or interchange, large. We, also, know this to be a fact; and unless some of the economies of these methods are shared with the public in the shape of reduced selling price, thus making possible an increase of business, it is extremely doubtful if these methods will permanently improve our industrial conditions.

"Scientific Management" and Labor Saving Machinery

"Scientific Management" has been likened to labor-saving machinery and the parallel is very close. In adopting it, however, we should recognize our obligations as well as our privileges and build for the future as well as the present.

Labor-saving machinery has greatly increased wealth and improved the conditions of civilized man, but with the increase of wealth has come greater relative differences between rich and poor. It is doubtful if the relations between employer and employee are any better today than they were two centuries ago.

During the time of such an enormous increase of wealth, many of our problems should have been solved, but they were not largely because an economic law was ignored.

In the utilization of this new instrument it will be of great benefit to the community if the laws of distribution are studied along with those of production. In considering the parallel between "Scientific Management" and labor-saving machinery, we may note that properly designed and operated labor-saving machinery, when applied to a suitable purpose, has produced great economies and assisted materially in the production of wealth. But when improperly designed or improperly operated it has often been a source of great expense. We may expect similar results with what has been called "Scientific Management."

The high sounding term "Scientific Management" should not be allowed to mislead anybody. It is not something that can be bought wholesale and utilized retail, but simply means study your problem according to "scientific methods," eliminating guess, setting each man a proper task, and affording suitable rewards for the accomplishment of these tasks. This done, increased efficiency is bound to follow.

The most effective safety devices do not consist of complicated machinery and expensive appliances. Rubber tips or sharp points attached to the feet of ladders prevent more accidents than costly guides attached to intricate mechanism. Simple but effective danger signs work wonders. (An electric warning sign that can be read in all languages, even by illiterates.)

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Radial Piercing Die

In the construction of automobile head lamps, the accuracy of alinement of the door hinge and door catch determines, to a great extent, the facility with which the door may be closed, and for this reason it is usually deemed advisable to punch both the holes for the hinge rivets and door catch at one operation.

The die for the accomplishment of this, in the case of a well known lamp, is shown in Fig. 2, while the door itself is shown in detail in Fig. 1, and is also indicated in position in Fig. 2.

Referring to Fig. 2, the die consists primarily of a cast-iron shoe or base *R*, having a circular central boss turned on it to locate the door for piercing. This boss is gashed at two points diametrically opposite, and two soft-steel blocks *K* and *M* are secured to *A* at these points by suitable fillister-head screws and dowels.

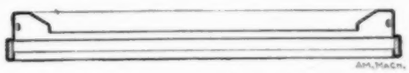


FIG. 1. THE DOOR TO BE PIERCED

It was found necessary to use the steel blocks for the reception of the piercing bushings *J*, as the cast-iron wall would have been too thin around the die bushings to stand up, this was due to the shape of the door preventing any extra metal being provided at these points.

The die bushings *J* are of hardened tool steel, pressed into *K* and *M*, the latter being provided with vertical holes through which the small disks from the holes may escape, falling down through the bolster plate and the press bed.

The piercing punches *H* are of drill rod and are inserted in the ends of the sliding plungers *F* made of hardened tool steel.

The vertical pins *G* act as stops to limit the stroke of the plungers, and also to back up the punches *H*.

The plungers slide in soft-steel blocks *B* and *N* and are pressed outward by helical steel springs *E*.

The punch holder *C* is of cast iron, with the usual shank for inserting in the press ram, and carries four shouldered wedge pins *D* at its extremities, to actuate the punch plungers *F*.

A flat steel spring *L* attached to the under surface of *C*, presses the lamp close down on the locating boss and holds it securely while piercing.

These dies are used in a standard press of 2½-inch stroke and are very easy to load and unload, as the flat spring *L* is the only holding device used to secure the door.

Detroit, Mich. ARON LAWRENCE.

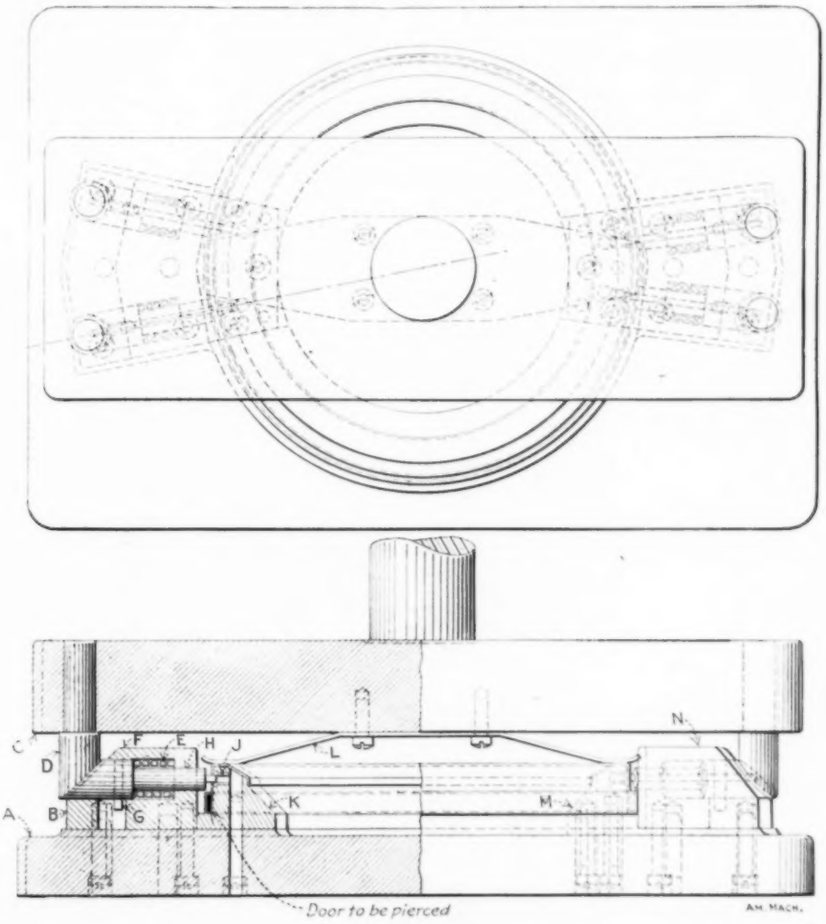


FIG. 2. RADIAL PIERCING

Why Did These Bearings Run Hot When Flooded with Oil?

I can vouch for every word of the following letter, which was written by a prominent engineer to Professor Sweet of Syracuse. His name is suppressed as I have no authority to use it.

"Some months ago we put in a new cupola fan. A 50-horsepower motor with bracings 4 inches diameter, to run 1500 to 1800 revolutions per minute. The motor was originally a turbo generator of 100 kilowatt capacity and ran about 2500 turns. We altered it to a variable-speed motor and it makes a fine cupola fan drive. But what I started to tell is that the bearings ran hot—too hot altogether—the boys rigged up a fine oiling system—a tank and filter up on the wall—pipes and sight feeds on the bearings—a hand pump for returning the oil to the filter, and everything tight so no dust could get in anywhere—a closed system in fact. But it ran hot, although there was a stream of oil running on the bearings.

"It went along some weeks that way before my attention was called to it. When I looked into it some of our turbine experience came back to me and I told them to cut down the oil to 40 drops per minute.

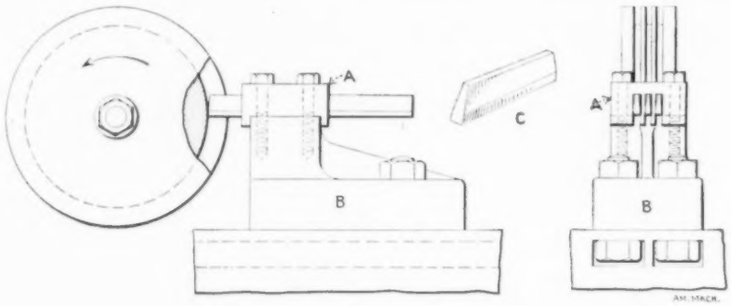
"Well, it ran cool at that—and kept on running cool—but all you have to do to make it run hot is to turn on plenty of nice clean cool oil."

Some years ago Mr. Hubbell, of the T. R. Almond Manufacturing Company, told me the casing of the Almond 90-degree drive should be filled to a certain point. Under these conditions the drive would run cool but if an excess of oil was put in the casing it would warm up.

New York. E. A. DIXIE.

Tool Post for Machining Grooves in Pistons

While working in a shop where we made various sizes of pistons, I was not satisfied with the single tool, this making a very slow operation. So I designed the post shown, which I think will prove an acquisition to small shops. No matter what the distance is between the rings, number of rings, etc., block *A* is machined accordingly. There are four clearance holes for screws by which block *A* is locked down to post *B*, allowing 1/64 inch for clamping the blades down. When the blades become dull, the operator takes them out, grinds them, pushes them forward, sets them square on the face, clamps them down, and the tool is ready for cutting again.



TOOL POST FOR GROOVING PISTONS

This tool is in use on a Ward turret lathe.

SID. STANLEY.

Wolverhampton, England.

Points on Efficiency in Tools and Jigs

For some three years I had a great deal of jig- and tool-design work under my personal care, and in that time had the opportunity to study the methods of and results obtained by a number of draftsmen, some of them well worthy the name, others not.

One man in particular, who was later put in charge, illustrates the point so well that I want to give his method of going at a job. In the first place, of course, he obtained a clear drawing of the part and the condition in which it came to the operation he was dealing with. He always dug up a sample of the piece if he could obtain one. Then he found out where it was going to be machined and got all the dimensions necessary from the machines themselves. Next he would find out the quantity to be produced and the probable length of time the jig or tool would be in active use. Then the foreman of the department was interviewed for any ideas or suggestions, and I remember he was so diplomatic at this that he put through a few tools that the foreman *made* successful, not because they embodied any particularly clever design, but merely because they—the foremen—had suggested some of the features and took a personal pride in the working of the tools.

What, you say, were the results of all this preliminary care and fussing? Well, they were varied, but some of them are on the honorable-mention list. In the first place, he helped to keep harmony between the shop and the designing room; he had thorough knowledge of conditions to be met by his design and generally met them well; he got all the valuable ideas and hints from the shop and worked them into his tools; and he was able to take a job from his chief and without constant watching, evolve ideas or elaborate those given him.

If all the tool designers would bear in mind the fact that the chief has his hands full laying out the work for his department and conferring with the heads of others closely related, and would learn to "use their heads" instead of their tongues, they would find their salaries rising, for men who do this are few and far between, and the chiefs are going to keep them if they can.

COST SHOULD BE CONSIDERED

To get back to the design again. The time is coming—in fact, it is here in many shops—when the cost of a proposed fixture or tool will be carefully considered. There are cases when entire special machines will pay for themselves on one operation on a single part, or where very intricate fixtures are economical in the long run; but on the majority of jobs the simplicity and consequent cheapness of manufacture of the jig must be as closely watched as its quick and efficient working.

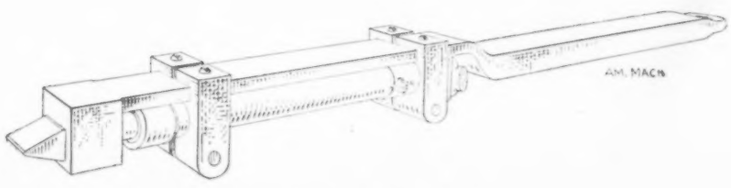
In the main, I believe the rule can safely be made that where the operation or actual machining time on an operation is short, and consequently a large number of pieces are handled, the use of quick locating and cam or lever clamping schemes are paying ones. Where, on the other hand, the machining time is long, simple clamps can be used with a very small proportionate loss of time.

Another point often ignored by designers is that the actual cutting time on as many pieces as the machine will hold is little, if any greater, than that on one lonely piece. This is particularly true of milling-machine fixtures. Get on all the pieces you can across the table and where the length of cut and relative position of cutters and work will permit it, use two fixtures, so that the operator can be loading one while the cut is running in the other. The great objection from the shop point of view to many fixtures is their lack of backbone; many good designs are spoiled because the originator failed to spend an extra quarter or so for cast iron. Don't forget that they will want to push your jigs to the limit most of the time.

Detroit, Mich. M. R. KAVANAGH.

A Heavy Chipping Tool

The tool is the result of a hard and steady job that came to the shop in the form of steel trolley frames with angle braces cut in the mold to prevent shrink cracks in the corners of the casting. The pieces to be removed were 2¼ inches high and long and about ¼ inch thick where they joined the casting. The regular chipping hammers made little headway. A sledge hammer and cold chisel were considerably better, but could not be kept going steadily. A heavy riveting hammer was tried, but would about dislocate a man's shoulder to keep it going; the recoil was too great.



A HEAVY CHIPPING TOOL

I figured that if I could secure a weight to the tool it would absorb the heavy vibration. I have distributed it over the entire length, making use of it as we went along. The lower end forms a square guide for a special heavy chisel 9 inches long and 1¼ inches square. A buttonhead rivet set is used on top of the chisel. Two clamps secure the frame to the hammer. The frame is forged with an extension on the side to fit on the top of the hammer head under the grip handle. From there it is bent around to come in line with the center of the tool, extending out about 3 feet, forming a handle for another man.

The whole tool weighs about 70 pounds and reduced the time on each piece from 2½ hours to about 20 minutes. It gets all the heavy jobs.

Cleveland, Ohio. A. I. LINSLEY.

A Novel Tracing Holder

It was customary in the locomotive works where I was employed to make the assembly drawing of the engine on a large sheet of paper with a cloth back, using a scale of 2 inches to the foot. The layout was made complete and very accurate, so that the details could be scaled right off. Of course, as the main design had to be used over and over again, it was necessary to handle it very carefully and we were not permitted to put thumb tacks in it.

Our tracing cloth was cut and printed to standard size and much smaller than the layout. The tracers used to put the tracing in place and then put various kinds of paper weights on it to keep it there, but a little erasing or careless handling would make it slip and then it would have to be readjusted. I devised the following arrangement to obviate the difficulty.

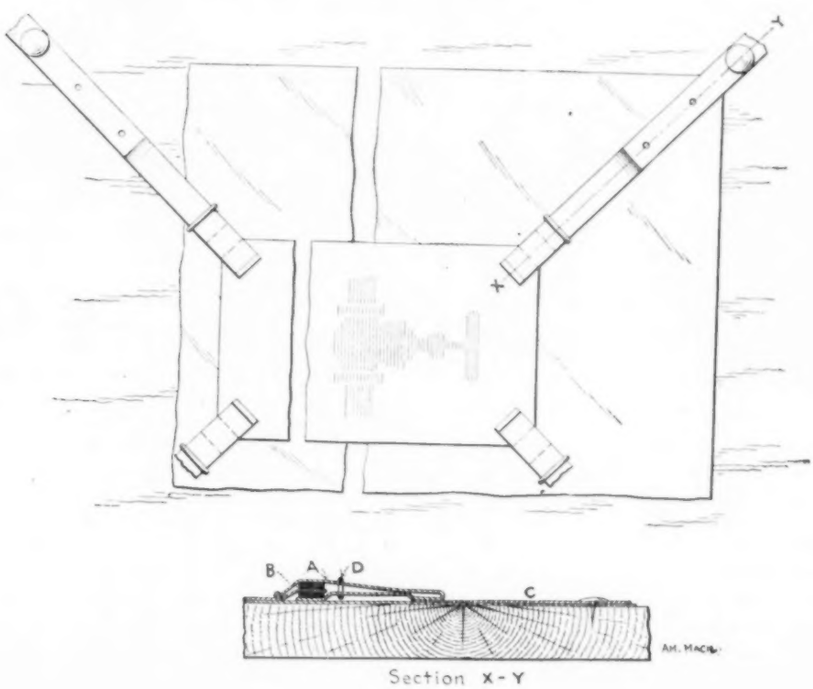
As shown in the accompanying figure, the clamp *A* has a sliding ring, rubber jaws *B*, and a tail end *C*; the clamp is made of thin, stiff spring steel about 1½ inches over all and ¼ of an inch wide. The rubber jaws are glued on. The very thin flexible steel tail end *C* is soldered onto the clamp. After the insertion of a corner of the tracing cloth the jaws are closed tight.

By sliding the closing ring *D*, as indicated in Fig. 1, the tail piece *C* presses the cloth down on the board.

Four of these holders are necessary, arranged as shown in the plan. The tail piece *C* is important, as it keeps the cloth down to the board as securely as a thumb tack, and also affords a better hold on the cloth on account of the little bend it creates in the cloth.

The little device was such a success that I made several for my fellow tracers.

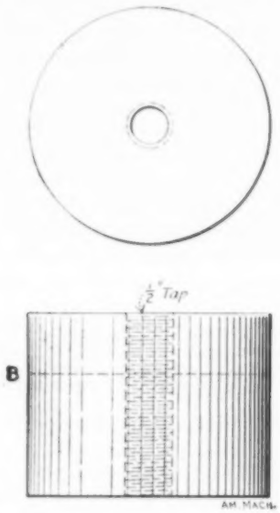
Hartford, Conn. J. C. P. BODE.



A NOVEL TRACING HOLDER

What Causes the Shrinkage in Punches?

The accompanying cut shows a punch that, when worn down to the dotted line *B*, was found to be 0.006 inch smaller than when new. It was also 0.003 inch larger at the base and 0.003 inch convex. The punch is made of carbon steel, and was hardened in the ordinary way, viz.: heated to a cherry red and quenched in brine and then drawn to a straw color, after which it is ground to size. It is used for punching 1/32-inch soft sheet steel, and is sharpened on a wet grinder. As there are a number of punches and dies, of various sizes and shapes, that show this tendency to lessen the area of



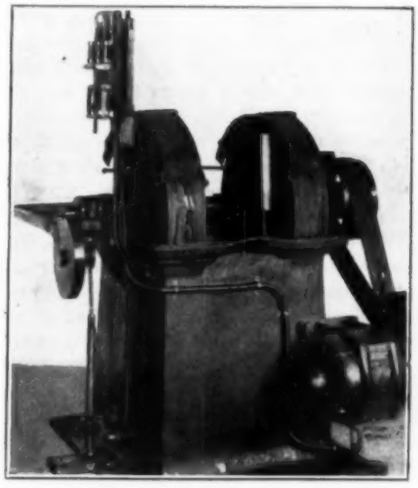
THE WORN PUNCH

their cutting face and a few that do not, I am puzzled to find out the reason for the shrinkage.

Ontario, Canada. H. T. M.

A Grinder Pump

The accompanying figure shows a pump which the General Electric Company is applying to old-style grinders throughout the factory. It can be made



A GRINDER PUMP

very simple in construction if properly applied to a new machine. You will note from the illustration that the piston does not come in contact with the water, as the water runs into the pump on the upstroke of the piston by force of gravity, and there is a check valve to prevent any suction of the piston. The check valve from the tank to the pump closes on the downward stroke of the piston and forces the water through the outlet check

valve to the spraying device on the wheel.

The function of the piston is to compress the air, which is taken in on the upward stroke, the pressure of the air to force the water outward on the downward stroke. A small air chamber is provided on top of the machine to give the water a steady flow.

The cylinder is made of a piece of ordinary brass pipe and the remainder of the fittings are regular piping. While we have a number of machines equipped with this pump, none of them has ever given us any trouble from leakage and although the first pump has been running for a year, we have not had to do any repair work.

Lynn, Mass. CHARLES K. TRIPP.

Blanking and Drawing Die for Searchlight Back.

When drawing shallow tray-shaped pieces, a combination blanking and drawing die is often found preferable to a separation of the operations into individual blanking and drawing. An example of this character of work is shown in Fig. 1, which illustrates a drawn-brass back for an acetylene searchlight of approximately 6 inches in diameter and 1½ inches depth, for the production of which a combination die, shown in Fig. 2, was used.

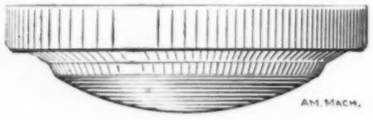


FIG. 1. OUTLINE OF LAMP BACK

The base of the die *A* is a cast-iron circular shoe with a square flange around its lower portion, by which it may be secured to the bolster plate with toe clamps and bolts. This casting is bored out to receive the hardened tool-steel ring *B*, which serves as a former for the reverse draw at the end of the press stroke. An ejector rod *C* of soft steel slides vertically through a central opening and is operated by the usual knockout attachment of the press. A hardened tool-steel ring *D* is screwed to the base and pilots over the previously mentioned ring *B*. It will be noticed that the outer edge of *D* acts as a blanking punch, while the inner surface is used as a drawing die. A soft-steel stripper ring *E* encircles *D* and is pressed upward by the helical coil springs *F* pocketed in the base and has its travel limited by the shouldered screws *G*.

The blank holder *H* is of cast iron provided with a locating groove on its upper surface to centralize it on the press ram. The blanking die *I* is a hardened tool-steel ring piloted in *H* and attached thereto by screws, as shown in the illustration. In addition to acting as a blanking die, this ring serves to hold the blank securely on the drawing die *D* during the descent of the drawing plunger.

The drawing plunger comprises a hollow cylindrical iron casting *J*, threaded at its lower extremity to receive the hardened tool-steel cap *K*, and at its upper extremity to fit the adapter stud of the press. Proper vent holes are provided in *K* and also in *J* for the escape of air during the drawing operation. The drawing plunger is a sliding fit within the blank holder to eliminate the possibility of side movement, caused by irregular flow of metal during drawing.

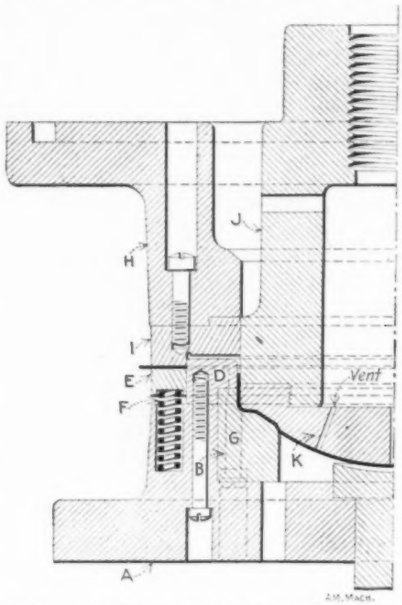


FIG. 2. BLANKING AND DRAWING DIE FOR SEARCHLIGHT LAMP BACK

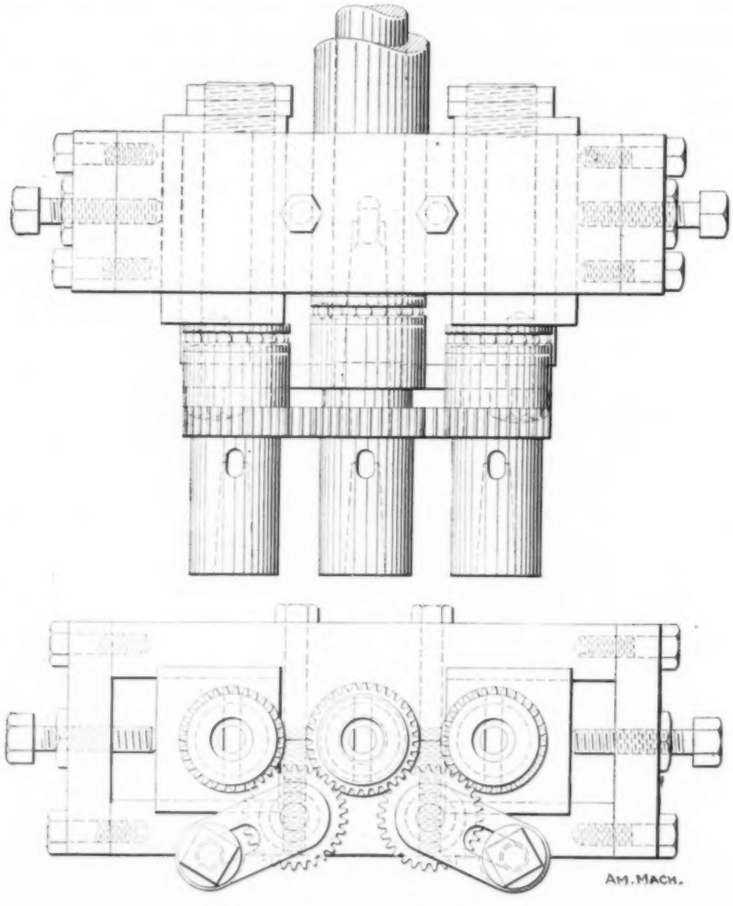
It should be borne in mind when using a die of this character, that the lower portion must be very securely fastened to the bolster plate and that the slides of the press ram must not be loose, as the correct alinement of the blanking punch and die depend entirely on this condition, without which shearing of the die will surely occur. No locating stops are needed with this tool, as the stock can be placed accurately enough by sight.

Detroit, Mich. A. L.

A Multiple Drill Attachment

I had some malleable castings to drill with two holes, from 17/32 to 1 inch and with centers from 5½ inches to 10 inches. To do the work I designed and made the fixture shown in the accompanying figure.

The fixture was cast in one piece, planed and bored, drilled, and then cut in two. The halves were laid side by side and the inside was flanged for the boxes. I made the boxes of bronze, the spindles



A MULTIPLE-DRILL ATTACHMENT

of steel, and the frame of cast iron. The gears were made of steel with brass bushings.

The fixture was bored the size of the spindle, and clamped with the screws for holding different centers for the jobs which were bored. The boxes were backed up in the jig by setscrews.

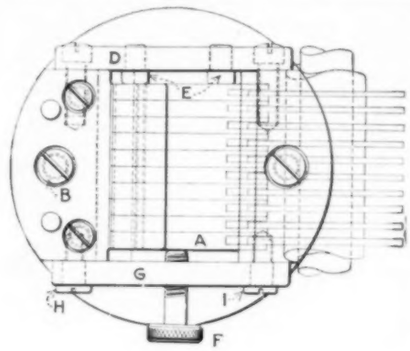
We ran 240 revolutions per minute with 5/8-inch high-speed drills and 0.023 feed. This speed worked perfectly, and increased our output about 300 per cent.

This fixture could be run as a 1-, 2- or 3-spindle driller.

Buffalo, N. Y. ALBERT SCHAUF.

A Milling Fixture for the Lathe

With limited machine equipment, especially in contract shops, there are many ingenious methods contrived for handling work that enable the desired result to be obtained without expending a large amount of money for new machinery, and some of these are well worth attention, although as a rule they do not become public property.



MILLING FIXTURE FOR THE LATHE

An example of one of these kinks is shown in the accompanying cut which illustrates a milling fixture used on an ordinary engine lathe for slot milling a quantity of punched brass levers of a peculiar form, one of which is shown in outline at *A*.

The usage to which the pieces are put demands a slot of such depth, that it is necessary to mill them from the hinge end toward the hook end, and as there was no means of elevating the work under the cutters in a lathe, it was necessary to feed the work across under the cutters which is, of course, contrary to usual practice on account of the tendency of the cutters to "hog in," especially in brass.

This trouble was found to exist after the fixture was placed in operation and was overcome by hanging a heavy weight on a cable which runs over a pulley at the rear of the lathe and is attached to the lathe cross slide, so as to take up the back lash of the cross-feed screw.

The tool post and upper rest were removed from the lathe cross slide and the fixture bolted on in their place by means of the special nuts shown at *B* which screwed onto the tee bolts of the cross slide. The base of the fixture is of cast iron, and is machined across its upper surface to form a cradle for the hook-shaped pieces to rest in. A steel retainer plate *C* of peculiar form is screwed to the top of the base and serves to hold the hooks in place while milling, ten of them being milled at a time. A steel side plate *D* equipped with resting studs *E* of hardened steel provides a firm stop against which the hooks are clamped by the action of the nurled screw *F*. This screw operates in a swinging arm *G*, pivoted on a shouldered stud *H* and swinging down over a second shouldered stud *I*. By raising this arm, the work is easily removed from the fixture and the cleaning of it is greatly facilitated.

The milling cutters are mounted on a steel arbor and are, of course, properly spaced by washers and this arbor is swung on the tail center and chucked at its left-hand end.

Some difficulty was at first experienced on account of the variation in thickness of the punched hooks, but the location of the slots was found to be sufficiently accurate to meet the requirements.

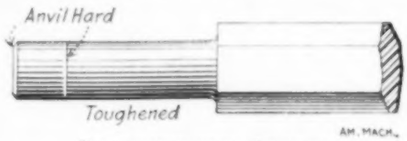
Detroit, Mich. ARON LAWRENCE.

Pneumatic Tool Shanks

It is apparent to me that a great deal of annoyance is continually experienced from the breaking off of the shank of the tool at the shoulder.

It is necessary that the end of the shank of the tool, where it receives the blow of the hammer, should be hardened to a certain extent so as to prevent upsetting and consequently enlarging; also to give it wearing qualities, and in order to obtain the best results the following is suggested: Take a pail and fill it about three-quarters full of salt water, covered with thin lard or fish oil to a depth not to exceed three-quarters of the entire length of the shank of the tool. Heat the shank a regular hardening heat and quench in this bath, being careful to keep the shoulder of the tool at the base of the shank, just on a level with the surface of the oil. Move the tool gently in this bath until entirely cold. Do not draw the temper, merely flash the oil from the tool.

It will be readily seen that if the action is performed quickly by the operator, the tip of the shank will be hardened more than the body of the shank, as it reaches the water practically before any cooling takes place, and the actual hardening of the end will take place in the water beneath the oil.



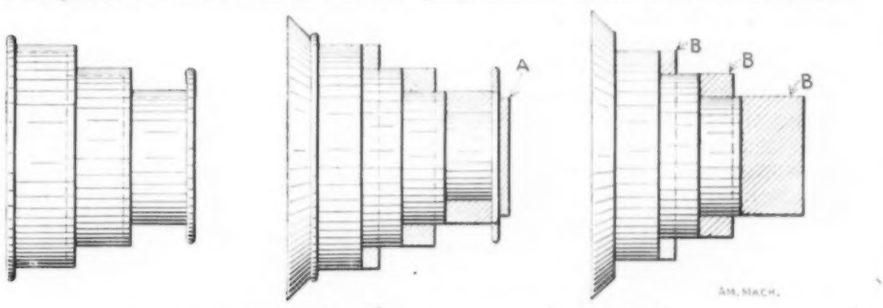
PNEUMATIC-TOOL SHANKS

This gives a shank hardened absolutely right without any further heat treatment, such as drawing the temper, and rivet sets treated in this manner have been known to drive as high as 24,000 rivets before crystallization took place.

Chicago, Ill. A. MONTGOMERY.

A Pulley Pattern Kink

Having an order for a special cone pulley, and not having time to make a new pattern and new core-box, the following method was used to fill the order. Fig. 1 shows the cone pulley desired and the shaded portions of Fig. 2 shows the pattern and core-print that we had.



FIGS. 1, 2 AND 3. THE PULLEY AND THE ALTERATIONS

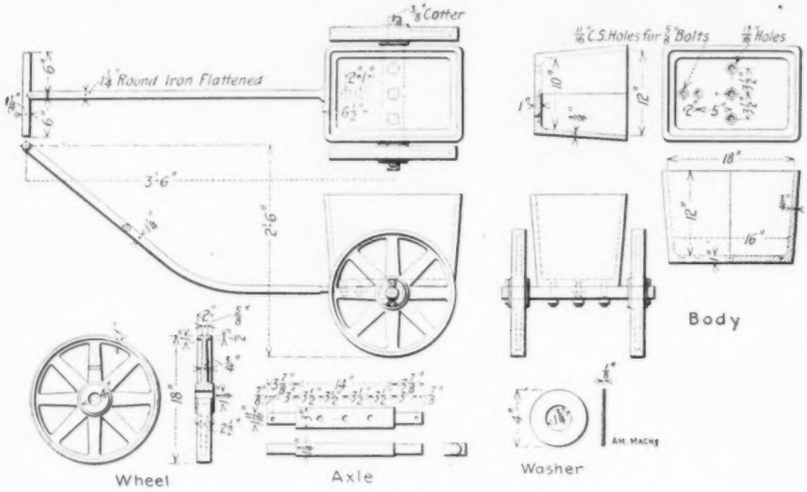
To make the pattern desired, the sectional portions of Fig. 2 are segments, which were attached to the original pattern. The core-print *A* was also attached to the pattern. The shaded portions of Fig. 3 show the original core. Circular core boxes were made, to make the portions of the cores, *B B B*, which were pasted to the original core.

This may be an old kink to the older mechanics, but will be quite new and instructive to the younger ones.

Dexter, Maine. DRAFTSMAN.

Slag Cart for Forge Shop Furnaces

In forge shops where large furnaces are used to heat the metal, there is a large amount of slag which must be taken out of the shop to the slag dump. On the accompanying drawing is shown a cart which is used to convey the slag. The body is made from cast iron. The cart can be pushed close to the furnace and the slag raked into the cart, whence it can easily be carted by one man to the slag dump.



A Slag Cart

The wheels are made from cast iron, and will stand a very heavy load; they are made large enough so that a load of slag can be tipped backward and dumped very easily. If roller bearings are used in the hub the cart will run more easily. The axle is made from a steel forging. This cart can also be used to convey coal, scrap iron, etc.

Toledo, O. W. H. Wolfgang.

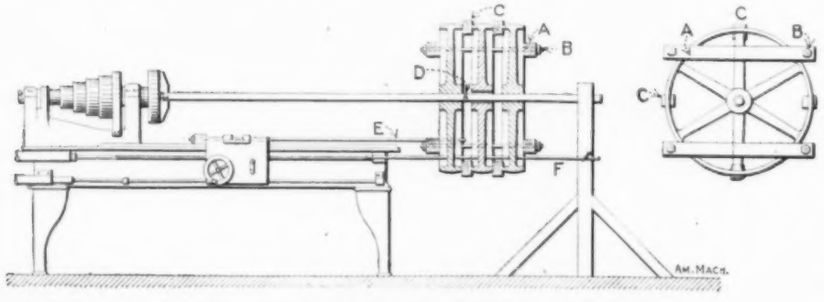
Boring a Large Pulley on a Small Lathe

Some time ago we had occasion to bore a pulley to fit on a shaft larger than was at first intended for it.

We had several of these pulleys on hand—all bored for a certain size shaft and all too large in diameter to be handled by any lathe or drill press in the shop. Reference to the accompanying cut will show the rig which was devised to do the job. Three of the pulleys were clamped together, using the timbers *A* and the bolts *B*, the pulleys being kept from contact with each other by the small wooden spacing blocks *C C*. A length of shafting the same diameter as that originally intended for the pulleys was procured, and a hole drilled through it to accommodate the cutter *D*, which was adjustable and which backed up by a setscrew in the usual manner.

The three pulleys were mounted upon this shaft, one end of which was held in the lathe, the other supported by timbering as shown. A short piece of timber laid back of the lathe carriage accommodated two rods *E*, whose ends hooked over the rim of the first pulley, while another rod *F*, passing between the pulley spokes and resting against the lathe bed and timber support, kept the pulleys from rotating with the shaft. All being in readiness and the cutter *D* properly adjusted for the first cut, the lathe was set in motion, the shaft acting as a boring bar while the carriage drew the pulleys forward, giving the required feed. One pulley only was bored, enough cuts being taken to finish the job, the outside pulleys acting as supports both for the boring bar and the central pulley.

Springfield, Ill. S. E. Codel.



Boring a Large Pulley on a Small Lathe

Drawing Kinks

I have found that it is possible and entirely practicable to do all lettering on tracings by means of a fountain pen. Until I tried it I supposed that the drawing ink would dry up and clog the pen but this is not so. The pen is ever ready; all that it needs is a little cleaning off whenever necessary. The lines, too, are much more regular in thickness than with the average steel pen and the method recommends itself for that reason also.

Another very useful idea in connection with the draftsman's outfit is the use of templets made from very thin celluloid. Trace the part that is often reproduced in your office on the celluloid by means of a sharp pair of dividers. It is necessary to trace on one side only and the object traced may be broken through, so clean that either the male or female part may be used. The templet saves an enormous amount of work where certain shapes are often reproduced.

Frederic Schaefer.

Pittsburg, Penn.

An Emery Wheel Dresser

We use a chunk of carborundum crystals for our coarse emery wheels used on the surface grinder to finish hardened steel.

A hole is drilled, large enough to take the chunk of carborundum freely in a cube of cold-rolled steel; we heat the steel hot enough to flow solder into the hole, then push the carborundum in and let it cool. When it wears down, reheat and set it over.

This makes a good dresser for soft bond wheels.

Springfield, Mass. C. Mack.

Methods of Writing on Blue Prints

To write on blueprints in white, several methods are commonly employed: Use commercial white ink; make a solution of "Chinese white" in water to the desired consistency; or use a bleach consisting of a solution of soda. Ammonia water can also be used, but is too thin to work well and the soda solution is generally the most satisfactory. The practice at some places is to add a few drops of bright red drawing ink to this solution, which will make pink marks and lines on the blueprint, and will show plainly that changes or additions have been made to the print, which is sometimes an advantage. To bleach a brown negative print, a solution of bichromate of mercury or corrosive sublimate works well. The strength of the solution to be used will vary with the intensity of the print.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Adulterations in Shop Supplies

Mr. Davis' article on page 639 on adulterations in shop supplies touches only too lightly on what has become a serious matter to the average machine-shop owner. It would seem that the time has arrived when the leading technical papers should publish a list of the worst offenders in the supply business.

For example, every machine shop of late has been flooded with circulars from several dozen "Lard Oil" and "Pork Products" concerns, who offer various grades of lard oils at prices calculated to suit both rich and poor. Most of these concerns are located at Cleveland, O., and apparently are one and the same.

During the past year I have ordered from the different advertisers several barrels of "lard oil," from the "Best Winter Strained" to "No. 1 Lard" at but 40 cents per gallon. Samples from each of the shipments were sent to a friend who is chemist for a soap concern and all were found to consist of straight paraffin oil with or without coloring matter. The joke of it is that the highest priced oil proved to be straight paraffin, while the cheaper and red-colored oils were simply adulterated with rosin oil costing, I am told, more than the paraffin.

In each case the fake oil concerns were required to pay the freight charges and trucking both ways, but still they come and now offer neatsfoot oil as a new line.

I think Mr. Davis is mistaken, in reference to gasolene, for the only inducement is to substitute a cheaper petroleum distillate which must at the present time be of greater density, so the hydrometer should give all the warning required.

Mr. Davis states that gas-engine cylinder oils containing graphite should never be used. I have never heard of graphite being produced in the process of distillation of lubricating oils and therefore suppose that he refers to graphite purposely added to the oil, in which case he certainly is in error, as to oil for large stationary engines at least. On my large producer-gas engine for several years I have used a power-driven grease pump that forces a heavy paste of graphite and oil into the oil-pump leads to the cylinders. By this means it is easy to feed the graphite as fast as desired without risk of clogging the oil pumps or connections. The device and method gave such good results that I decided to patent it, but found the idea to be very old.

After several years' liberal use of graphite the cylinders are almost as good as new and the tool marks still appear over nearly their entire surface. I have not noticed any tendency of the graphite to adhere to the piston head and cause preignition. The graphite in time completely fills in the space under the last two piston rings where the heat is high, but, as those rings are always free and show no abnormal wear, I am sure there is no crowding action. I feel sure that the life of both cylinder and piston will be greatly extended by the liberal use of graphite.

Plainfield, N. J. S. W. RUSHMORE.

Night Schools for Machinists

Your correspondent, Joseph A. Haigh, writing on page 366, would like to hear the opinions of some other readers as to the desirability, or otherwise, of establishing night schools for machinists.

Speaking from the Midland counties of England, there would appear to be no necessity to establish schools other than those we already possess, in the way of evening continuation and municipal technical schools. Here in Birmingham and the neighboring Black Country towns we have some of the finest schools to be found anywhere. Most of the technical schools include in their courses, practical as well as theoretical instruction in the trades peculiar to the district in which they are located. The Central Technical School at Birmingham has workshops and laboratories second to none for the instruction of students in mechanical, electrical and civil engineering. Classes are held for bricklayers, carpenters and joiners, and brass and metal workers The courses include metallurgy, metallography, electrodeposition of the various metals, motor-car design and construction, iron-founding, steel-smelting, farrierry, dressmaking, cooking and domestic economy.

Practically the only conditions of entry to these classes are that the student attend a specified number of classes per course, and that with any workshop or laboratory course he take the associated lecture course; in fact, the student must take simultaneously the practical and the theoretical.

As an example, let us suppose that your correspondent is a planer hand or driller in a large works. He thinks he would like to become an all-round machinist or toolmaker. If he were here in Birmingham he could enter the engineering workshop, where he would find the complete equipment of a general machine shop, lathes, drillers, planers, shapers, millers, grinders and all the necessary small tools. He would be able to receive instruction in practically any branch he chose, providing he undertook also to study the accompanying mathematics. This is as it should be. Every class night before work is commenced the students assemble in the workshop and listen to a short lecture on the nature of the materials used, and are shown how to make the necessary calculations.

In the same way carpenters are taught the science of the timber they use, where it is grown, its suitability for various purposes, and the best ways of converting it from the log by hand as well machine processes. They also must study mathematics as applied to their art. The range of the subject is from a simple joint to staircase and handrail.

In these classes the students are of all ages. I have seen father and son taking the same course at the same time. Provision is made for visits to various industrial concerns. This is a very valuable feature as it gives the worker the opportunity to see other plants and other methods.

GEORGE W. SMITH.

Birmingham, England.

Suggests a Draftsman's Workbasket

It is almost amusing to read some of the suggestions for draftsmen that are contributed to the AMERICAN MACHINIST, such as the "weighting" of a lead pencil so that the point will not break when it falls. And many others, if they were followed, would make a draftsman's outfit resemble a workbasket.

But the limit is reached by Mr. Sterling when he says, page 461, that most draftsmen find it difficult to neatly indicate broken parts and that a templet is found useful.

Mr. Sterling is the first draftsman whom I ever knew having any difficulty in this matter; certainly it was never much of a task for me. It can be done neatly with any good lettering pen, and

if detail work is being done, where heavy lines are used, a ball pointed pen will be found just the thing.

There is only one man that I ever met who might find this templet useful, that that was a carpenter whose drawings I used to trace when I was a beginner in the drafting room. He was left handed and his drawings were heartbreaking. But the average draftsman would not consider this important enough to consider, and it is not.

I must thank Mr. Sterling for the way of "cementing" celluloid by alcohol. It is new to me and will probably come in handy some time.

ARTHUR N. PATTERSON.

Cold Spring, N. Y.

White Lead as a Remedy for Hot Guides

Some time ago in the columns of the AMERICAN MACHINIST, flowers of sulphur, i.e., sulphur in powdered form, was recommended, mixed with engine oil, as a remedy for hot bearings.

I have used this at sea with remarkable results. But I am of the opinion that as a remedy for hot guides (cast-iron sliding on cast iron) nothing can beat ordinary white-lead putty mixed with engine oil to a liquid rather thinner than mixed paint.

White lead used in this way has results quite as remarkable as the sulphur remedy; from personal experience I can testify to its undoubted merits.

London, Eng. A. L. HAAS.

A Suggestion and a Question

In looking through the pages of the AMERICAN MACHINIST one comes across many articles describing accurate tool and die work, some of it being very fine indeed. These articles are very interesting and instructive, but would be much more so, if the time consumed on the jobs were stated.

Such an article I have in mind in "A Piece of Precision Die Work," by Gustav Korinek on page 916.

This shows an elaborate tool and elaborate fixtures and gages for making it. In most shops I have been in, the cost of such fixture and gages would have been absolutely prohibitive.

If the total time consumed on the job were stated, one would have an idea of whether such methods were allowable or not. I think a statement of the total time on a job would add greatly to the value of many of the articles published.

On page 1073 there is an article, "The Practical Use of the Sine Bar," by H. P. Camp. This is a very interesting article, but in all his examples Mr. Camp figures his hights to ten-thousandths of an inch and then lays them out with a vernier hight gage.

Now, how does he read the ten-thousandths on a vernier hight gage? It is easy enough to read half a thousandth, but quarter thousandths are secured almost by chance and as for ten-thousandths, that is beyond me altogether.

I take it that Mr. Camp reads to the nearest half thousandth.

Notts, England. T. H. JETHART.

Representing Broken Parts on Tracings

With reference to Mr. Sterling's contribution on this subject, page 461, the writer is of the opinion that the same result may be attained in representing broken parts on tracings by the employment of an ordinary triangle, eliminating the necessity of providing a special templet.

The triangle should be used with the right corner bearing on the board, and the right hand, or working hand, resting thereon, while the left hand supports its respective end of the triangle aloft from the drawing. By using the part which rests on the board as a pivot, and moving the triangle gently to and fro, as required, a wavy line, of even thickness and edge, may be easily executed with the ruling pen. The T-square may be put to the same purpose for work of greater magnitude.

Ordinarily, however, the use of any guide for this work is rarely essential to one proficient to any degree in drafting work, as either with ruling pen or common steel lettering pen, using care for equal pressure in the latter, broken parts are ably represented, with uniformity, freehand.

Los Angeles, Cal. L. R. W. A.

English Standard Pipe Threads

On page 937, Part 1, a table of English standard pipe threads was published, which was evidently taken from the report of the Engineering Standards Committee, issued in April, 1905, at which time the work of this committee was incomplete, and unfortunately the table lacks some information necessary for its use.

The table herewith is taken from the revised report of this same committee, which was issued in November, 1909. Original copies may be secured from the committee's offices in London, at 28 Victoria street, Westminster, S. W. The title is Report 21 on British Standard Pipe Threads for Iron or Steel Pipes and Tubes; the price is 2s. 8d., postpaid. All but the last two columns of the table herewith are copied from this report, and the last two columns are computed from the gage diameter and its distance from the end of the pipe in order to get a dimension similar to that used by American manufacturers in cutting Briggs standard threads.

Nominal Diameter of Pipe	Approximate Outside Diameter of Pipe	Gage Diameter, Top of Thread	Double Depth of Thread	Bottom Diameter of Thread at Gage Point	Number of Threads per Inch	Distance of Gage Diameter from End of Pipe			Outside Diameter of Thread at End of Pipe	Inside Diameter of Thread at End of Pipe
						Standard	Maximum	Minimum		
	3/8	0.383	0.046	0.337	28	3/16	0.18	0.13	0.373	0.327
	1/2	0.518	0.067	0.451	19	1/4	0.22	0.16	0.506	0.439
	5/8	0.656	0.067	0.589	19	1/4	0.29	0.21	0.640	0.573
	3/4	0.825	0.091	0.734	14	1/4	0.29	0.21	0.809	0.718
	7/8	0.902	0.091	0.811	14	1/4	0.29	0.21	0.886	0.795
	1 1/16	1.041	0.091	0.950	14	1/4	0.44	0.31	1.018	0.927
	1 3/16	1.189	0.091	1.098	14	1/4	0.44	0.31	1.166	1.075
1	1 5/16	1.309	0.116	1.193	11	1/4	0.44	0.31	1.286	1.170
1 1/4	1 5/8	1.650	0.116	1.534	11	5/16	0.58	0.42	1.619	1.503
1 1/2	1 7/8	1.882	0.116	1.766	11	5/16	0.58	0.42	1.851	1.735
1 3/4	2 3/16	2.116	0.116	2.000	11	5/16	0.73	0.52	2.077	1.961
2	2 3/8	2.347	0.116	2.231	11	5/16	0.73	0.52	2.308	2.192
2 1/4	2 5/8	2.587	0.116	2.471	11	3/8	0.80	0.57	2.544	2.428
2 1/2	3	2.960	0.116	2.844	11	3/8	0.80	0.57	2.917	2.801
2 3/4	3 1/4	3.210	0.116	3.094	11	3/8	0.95	0.68	3.159	3.043
3	3 1/2	3.460	0.116	3.344	11	3/8	0.95	0.68	3.409	3.293
3 1/2	3 7/8	3.700	0.116	3.584	11	3/8	1.02	0.73	3.645	3.529
3 1/2	4	3.950	0.116	3.834	11	3/8	1.02	0.73	3.895	3.779
3	4 1/4	4.200	0.116	4.084	11	3/8	1.02	0.73	4.145	4.029
4	4 1/2	4.450	0.116	4.334	11	1	1.17	0.83	4.387	4.271
4 1/2	5	4.950	0.116	4.834	11	1	1.17	0.83	4.887	4.771
5	5 1/2	5.450	0.116	5.334	11	1 1/8	1.31	0.94	5.380	5.264
5 1/2	6	5.950	0.116	5.834	11	1 1/8	1.46	1.04	5.872	5.756
6	6 1/2	6.450	0.116	6.334	11	1 1/8	1.60	1.15	6.364	6.248
7	7 1/2	7.450	0.128	7.322	10	1 1/8	1.60	1.15	7.364	7.236
8	8 1/2	8.450	0.128	8.322	10	1 1/8	1.75	1.25	8.356	8.228
9	9 1/2	9.450	0.128	9.322	10	1 1/8	1.75	1.25	9.356	9.228
10	10 1/2	10.450	0.128	10.322	10	1 1/8	1.90	1.35	10.348	10.220
11	11 1/2	11.450	0.160	11.290	8	1 1/8	1.90	1.35	11.348	11.188
12	12 1/2	12.450	0.160	12.290	8	1 1/8	1.90	1.35	12.348	12.188
13	13 1/2	13.680	0.160	13.520	8	1 1/8	1.90	1.35	13.578	13.418
14	14 1/2	14.680	0.160	14.520	8	1 1/8	2.04	1.46	14.571	14.411
15	15 1/2	15.680	0.160	15.520	8	1 1/8	2.04	1.46	15.571	15.411
16	16 1/2	16.680	0.160	16.520	8	1 1/8	2.19	1.56	16.563	16.403
17	17 1/2	17.680	0.160	17.520	8	2	2.33	1.67	17.555	17.395
18	18 1/2	18.680	0.160	18.520	8	2	2.33	1.67	18.555	18.395

Taper of pipe ends = 1/16" to 1".
Whitworth standard threads.

BRITISH STANDARD PIPE THREADS

E. G. GREENMAN.

Cincinnati, Ohio.

Black waterproof dressing may be made by mixing together 7 lb. best black paint, ½ lb. powdered litharge, 1 pint oak varnish, ½ pt. boiled linseed oil and ½ pint thick boiled oil. Apply as ordinary paint. It is especially good for railway and wagon coverings, tarpaulins and such articles.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 10 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For October,* 1911 *(American weekly, American monthly, English weekly and German weekly) total,* 94,750.

Of this issue 27,500.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 217

American Machinist

The Machine Tool and Its Pump

It is thought by some observers that in the general advance in machine design and construction, certain rather important details have been given a little less consideration than they deserve, at least from the point of view of the operator. As an example, the oil pump may be referred to as commonly applied to modern machine tools.

Recently an oft-repeated criticism has come to our attention to the effect that the pump as ordinarily attached is above the level of the liquid and consequently requires priming in the majority of cases, if stopped even for a comparatively short period. Where a check valve is used and oil is the liquid pumped, under ordinary conditions there may be no difficulty experienced in holding the liquid; but a bit of dirt or other foreign substance may render the valve inoperative, and in some cases where there has been no trouble while using oil, a change to some solution has made it necessary to prime the pump each time after stopping.

Upon superficial consideration it might be supposed that the pump could always be located below the water level as easily as above it. And, as a matter of fact, while not feasible in all cases this could be done in various instances where it is not at the present time, and an element of inconvenience of operation and delay eliminated.

On machines erected with cabinet columns and with internal mechanism carried well down toward the base, there is oftentimes a real difficulty in placing the pump to the best of advantage, and the designer is apt to be confronted by the fact that much as he would like to locate the pump below the tank, he is not able to put the tank above the pump and still keep within the limits of a suitably proportioned column. However, the problem is solved satisfactorily by makers of grinders who place the pump directly inside the tank where it is near the bottom of the soda-water solution and can never require priming.

With such tools as lathes, screw machines, etc., the placing of the pump above the liquid level would appear to be more a matter of convenience of construction than because of any fundamental difficulty in locating it otherwise. The common position of the screw-machine pump, for example, makes it possible to use shorter driving connections in the way of chain, belt or shaft, and less piping than would be required with the pump dropped below the tank. Nevertheless, the advantages gained by the latter position would seem to warrant its more general adoption by tool-machine designers.

Woman Labor in Machine Shops

Recent articles in the daily press have called attention to the fact that a few women are employed in machine shops and foundries. An attempt has been made to draw upon the sympathies which people are supposed to have for women who work at anything except housework. Admitting for the moment that woman labor in the producing departments of machine shops presents an industrial problem, legislation has little to do with its solution, and public opinion much. At the same time we notice that public opinion is changeable and varies from time to time.

We do not wish to discuss the time-honored question as to whether women should be contented with caring for their husbands, their children, and their homes, or should compete with men in the work of the world; but we do desire to call attention to the fact that when women seek to enter a vocation they invariably use that most potent of all selling forces —cut prices. Industry demands low costs; consequently if women decide to work in shops they undoubtedly will do so.

But when women enter our machine shops and foundries as wage earners, it is the duty of employers to surround them with conditions so favorable that no harm can come to them from that employment. Of course the same obligation rests upon employers in regard to the working conditions of men employees. Unfortunately these have been disregarded far too often in the past; but the movement toward improved sanitation, heating, ventilation, artificial lighting, and so on, shows that a change for the better is under way. There is today no excuse for erecting and equipping a new factory in which these indirect production factors are not adequately studied and provided for.

Some of the newspaper articles mentioned in our opening paragraph have emphasized that the work done by the women was hard muscular work, necessitating the lifting and carrying of heavy loads, and that the rooms were so hot that the women removed a portion of their clothing. Even if these statements are true, there is nothing to prove that in the first case the work was injurious, nor in the second case that temperature conditions were the sole cause.

The writers of the articles referred to have perhaps not noticed that many of the women employed in foundry core rooms are of foreign birth, are used to heavy muscular work and are as capable of doing it as the average man. Again, habits and the desire for free muscular movements are more often the reason for discarding some parts of conventional clothing than the temperature in which a person is working; and this without violating any feeling of modesty. But to us the statements appear to be biased and exaggerated. We have visited numerous foundries where women are employed in the core rooms and always found them seated at benches, making small cores and in a temperature no different from that found in other shop departments.

Referring, however, to some of the obligations of employers of women in machine shops, if the number of women is less or even equal to the number of men employed in a given building, the sexes should be segregated. This will be to the benefit of both. Furthermore it is wise to so arrange the hours of working that the women can enter the plant a few minutes after the men have begun work and leave a few minutes earlier. This gives them a better opportunity to get seats on the street cars, if they are used, in coming to and going from work, and prevents the crowding and jostling that

we sometimes see under other conditions. A few plants that we know of have a private entrance and exit for women. This is a commendable arrangement.

Another feature that has been found necessary in vocations already taken over by women is allowing rest periods. The physical condition of the workers is demanding our attention. Most employers, we believe, realize that the greatest good in the long run comes from employing men and women who are in the pink of condition at all times. This obligation—or better, necessity—of promoting the physical wellbeing of employees is even greater in the case of women than of men.

Babbitting

The babbitting equipment often seen in machine shops argues that the belief is held "anything is good enough to babbitt with." Old ladles, encrusted melting pots, either gas- or forge-heated, and a miscellaneous collection of arbors, clamps, etc., are frequently in evidence. The metal itself is usually purchased on brand without any specification as to chemical composition or physical properties. Old babbitt from worn out bearings and the fins and scrap that always accumulate on a babbitting job are returned to the pot and remelted.

No one knows how hot the metal is, or has been, aside from a guess based on the charring of a pine stick.

All this is common, but not representative of the best practice in using babbitts.

Commercial white bearing metals vary widely in composition not only between different brands, but even between different lots of the same brand. Some are nothing better than waste metal from type foundries or "clean-up" from smelteries. The brand and trade mark are often attractive. Of course, there are dealers who will guarantee a chemical analysis and furnish a specified alloy with none of the constituents varying more than one-half per cent. from the standard set. But many metals will not meet any such requirement.

Some careful users of babbitts, however, are not satisfied even with this assurance of quality, but prepare their own alloys from ingot metals. The control of special formulas may be another governing reason. Further, no scrap or waste metal is allowed to be remelted in the shop. All such is sent back to a refining room and used to make ingots of the particular alloys needed. Only babbitt in ingots or bars as sent out from the refining room can be melted in the shop. This controls the composition and original physical properties of the metal used.

In the refining room chemical analysis alone is not relied upon, but physical tests are also made. The Brinell hardness number is considered as especially important. The tensile strength, elongation, reduction of area and compressive strength are likewise studied.

All this, to insure that the metal reaching the melting pot has the properties desired.

But the watchful care does not end here. The temperatures of the molten metal are watched. It is recognized that if the metal is allowed to get too hot it will be injured; if an attempt is made to pour it too cold the lining will not be what is desired; for the rate of cooling affects the final condition. Thus the pouring temperature must be, in a measure, adapted to the section being poured. A thin section will cool quicker than a thicker one.

Thus the temperature of pouring is fixed between limits and a maximum temperature that must not be exceeded, is determined.

The extreme care in mixing and controlling the alloys is justified from the knowledge that even small quantities of some metals have an injurious effect on the final physical properties. The care in controlling the melting temperatures is justified for a similar reason, to insure that no injurious charges in physical properties will take place.

The Cost of Overinspection

The individual who is overcritical or "fussy" usually pays for his attitude and methods by a decreased production. Jobs that must be done on time are not given to the putterer.

The same unfortunate result meets the overcritical firm. Overinspection costs money and wastes time, brains and materials. We do not refer so much to the inspection of machine parts and finished machines—though, here, overinspection is an expenes—but rather to the inspection of materials, etc., purchased on contract.

A firm that inspects down to the last fraction of the letter of the specifications soon becomes known to the trade and the shrewd bidder adds to his price as he thinks is necessary to repay him for the overinspection that he knows will follow. Such a firm, if known, does not get as fair a bid as one that has a less critical reputation.

Thus this kind of a reputation is expensive.

Another source of expense is the wages and traveling expenses of inspectors who are sent out to look over materials or supplies at the place of manufacture. Is there any economy in sending an inspector 500 miles to pass 100 pounds of steel, or across the Atlantic to look over $1000 worth of pipe ordered in Germany? The cost of inspection instead of being a small percentage of the cost of material purchased may be out of all proportion to that cost. Thus injudicious inspection is expensive.

The overcritical inspector, the stickler for details, may have imperfect work put over him just to see if he is as shrewd as he appears.

We have seen a steam-engine cylinder condemned to the scrap heap because of a blow hole in the bore which would barely take the head of an ordinary pin. What possible harm could such a blow hole do? We have seen a large casting condemned by the same inspector because it was bored a couple of thousandths over the size called for on the drawing, when it would not have mattered even if it had been bored one-quarter of an inch large. This same condemned casting was later passed as O.K. The lathe hand who bored it, placed it in a cool place and laid the test gage in the sun. After a little they fitted and the inspector was satisfied.

Sanity is a prime requisite in the inspecting department and produces real savings.

Personals

Charles Gingrich, of the Cincinnati Milling Machine Company, presented a talk before the Cleveland Engineering Society on October 24, which dealt with modern machine-shop milling processes.

Charles E. Crofoot, for several years connected with the Boston Gear Works, acting in various capacities, has established the Crofoot Gear Works, Haverhill, Mass., of which he is to be general manager.

Robert Mather

Robert Mather, chairman of the board of directors of the Westinghouse Electric and Manufacturing Company, and a prominent figure in railroad and financial circles for many years, died at his home in New York City, October 24. He was 52 years old.

At the age of 13 he entered a factory, working three years to learn how telegraph instruments and switchboard apparatus were made. Later he obtained his first railroad experience in the office of the master mechanic of the Chicago, Burlington & Quincy Railroad. While working there he managed at nights to prepare for college, and in 1882 he was graduated from Knox College. From 1882 to 1885 Mr. Mather worked in the treasurer's office of the Chicago, Burlington & Quincy road, devoting his spare time to the study of law, and in 1886 he was admitted to the Illinois bar.

From 1889 to 1909 Mr. Mather grew to be an important figure in the railroad world, during which time he held office in many railroad companies.

In January, 1909, at the time of the reorganization of the Westinghouse Electric and Manufacturing Company, Mr. Mather was elected chairman of its board of directors, and thereupon severed his railroad connections.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Heavy Cold Metal Sawing Machine

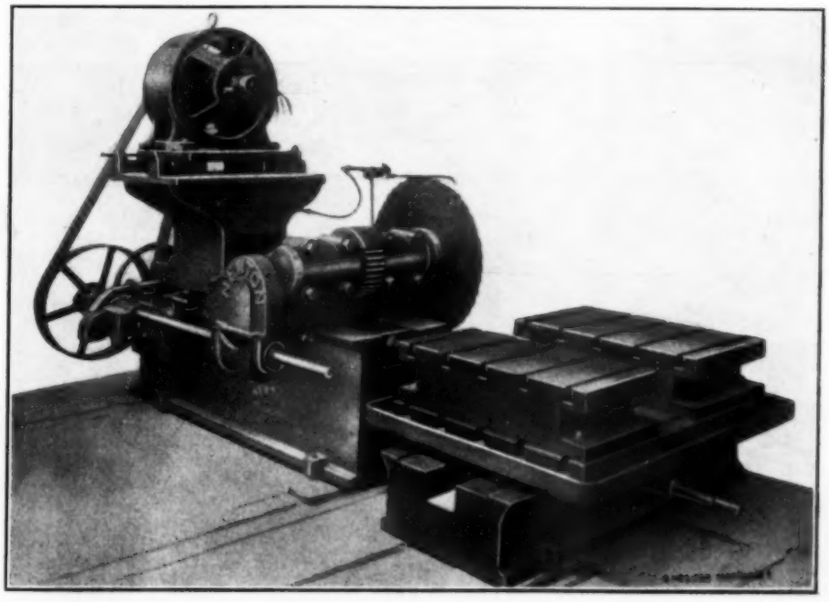
The accompanying halftone shows a 32-inch cold-metal sawing machine, of the steel-foundry type, recently developed by the Newton Machine Tool Works, Philadelphia, Penn.

The diameter of the saw blade is 32 inches, capacity for gates or risers is for 9½ inches diameter in one cut, and length of travel of feed to the saddle is 14 inches.

The machine is of the spindle-driven type, the spindle revolving in bushed capped bearings and is supported at each end. The driving-spindle gear is mounted between them. The drive to the spindle is by means of broad-face steel gears, and the teeth of the driving pinion meshing with the spindle gear are cut in the worm-wheel shaft. The driving worm wheel is a bronze casting and the driving worm is of hardened steel; both the worm and worm wheel are incased for continual lubrication. The bearing for the worm wheel is cast in one piece with the saddle. The saddle is of heavy construction, has square bearings on the base with underlocking gibs cast solid, and the adjustments are made by means of taper shoes. The saddle has a bearing on the shears the full length of the saddle.

The machine is fitted with gear feed, having six changes, and quick return, and by the use of a double-throw switch or reversing motor, power traverse is available in both directions. The saddle is fitted with adjustable, automatic and positive safety release to the feed and fast traverse.

The work table is 36 inches wide by 48 inches long, entirely surrounded by an oil pan, is fitted with five T-slots, and there is 20 inches of hand-cross adjustment. The auxiliary parallels are each 16 inches wide, 36 inches long, 9 inches high and fitted with five T-slots. These are provided to permit of clamping the work closely on each side of the new blade and still maintain clearance for the blade.



COLD-METAL SAWING MACHINE

A High Speed Grinder

The Waltham Watch Tool Company, Springfield, Mass., has recently put on the market the high-speed grinder shown in the halftone. This grinder is built in two sizes to meet the demand for an internal grinder having a high-speed spindle which will accommodate the small wheels adapted for internal grinding and drive them at their correct cutting speeds.

Fig. 2 shows the spindle and quill, and indicates clearly the construction of the parts and the method of oiling. The casing *A* has inserted in its front end, a fixed bearing holder *C* secured by the set-screw *F*, and in its opposite end an adjustable bearing holder *C1*, with a

FIG. 1. HIGH-SPEED GRINDER

threaded adjusting collar *D*. The inner ends of these bearing holders contact with the shoulders *J3 J3* of the spindle *J* and govern the endwise adjustment of the spindle. Inserted in the bearing holders are split taper bearings *G G*, made of bronze and in these are taper-adjusting screws *I I*. Threaded caps *B* and *B1*, having lever holes *B2*, bring pressure against the ends of the bearings *G G* and hold the parts firmly in place. Extending members *B4* on the caps, enter recesses in the pulleys *N* and serve to protect the spindle and bearings from emery and dust. On the central part of the spindle are two collars or flanges *K*, which enter an oil reservoir and in their

revolutions throw the oil freely to the walls and roof of the casing. A long trough *L* secured by screws *M* receives a portion of this oil and conducts it to the felt filtering pads *R*. It then flows through conduits to the bearings and spindle and back to the reservoir, as indicated by the arrows. Annular recesses in the caps *B* and *B*1 connecting with the channels *G*1, provide for the return to reservoir of any oil which may work beyond the ends of the spindle bearings. Oil holes *C*4 assist in keeping the shoulder bearings flooded. A sight glass *U* on the outside of the casing indicates the oil level.

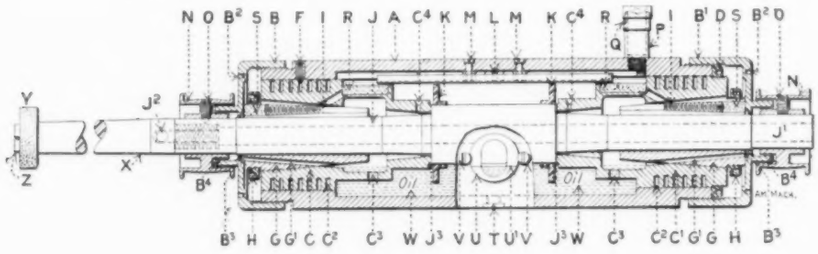


FIG. 2. THE SPINDLE AND QUILL

This spindle has run continuously for 10 hours at 30,000 revolutions per minute.

The table is operated by a reciprocating member, which receives its motion from a heart-shaped cam. The position of the roll which transmits the motion of the reciprocating member to the table can be altered while the machine is in motion, if desired, and any throw of the table from zero to the full throw obtained. With this reverse mechanism no space is necessary for the operation of the reverse mechanism.

In a cam-operated machine it is important to have sufficient changes of feed to maintain a practically uniform rate of travel when the stroke of the cam is changed; for this reason 15 changes of feed have been provided. The feed can be instantly disengaged from the cam at any time.

For inspection or testing of work the table can be released, thrown back and returned to its previous setting. Table length No. 3 machine, 29 inches; No. 4 machine, 34 inches. Stroke No. 3, 0 to 4 inches; No. 4 machine, 0 to 6 inches. Swing No. 3 machine, 9 inches; No. 4 machine, 9½ inches. Number of changes of feed No. 3 machine, 15; No. 4 machine, 21. Weight No. 3 machine, 900 pounds; No. 4 machine, 1300 pounds.

[In the illustrated description of this machine appearing at page 806, the reference letters in Fig. 2, showing the spindle and quill construction were inadvertently omitted. So that the construction of the machine may be clearly understood the entire article is republished.—EDITOR.]

Two New Standard Automatic Millers

The Standard Manufacturing Company, Bridgeport, Conn., is making two automatic millers, one for milling racks up to 22 inches in length, 4½ inches wide, and 10 pitch, and the other for milling worms from ½ to 3 inches in diameter up to 10 pitch, single or multiple thread.

The rack miller, with five tracks one inch wide in place, is shown in Fig. 1. The cutter *A* is carried in a vertical head *B* on the end of slide or ram *C* and is driven by the belt and pulley *D* through a chain of gears at the opposite end of the spindle, these gears being so arranged that the spindle may be brought down very close to the work without interference.

THE CUTTER FEED

The forward feeding movement of the cutter is given to the ram carrying it, by the cam *E*, which is operated by the belt and pulley *F*, through the worm *G* and worm gear *H* on the same shaft with the cam, the action of which will be more clearly understood from the view of the opposite side that will be shown later.

The vertical movement of the head *B* is controlled by strong springs within it, which have a tendency to force it upward, and also by the lever *I*. The cam *J* is so

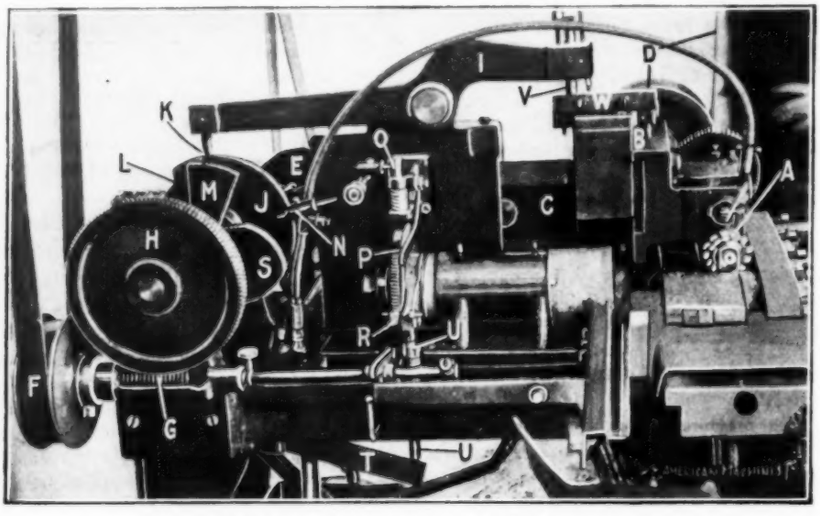


FIG. 1. AUTOMATIC RACK CUTTER

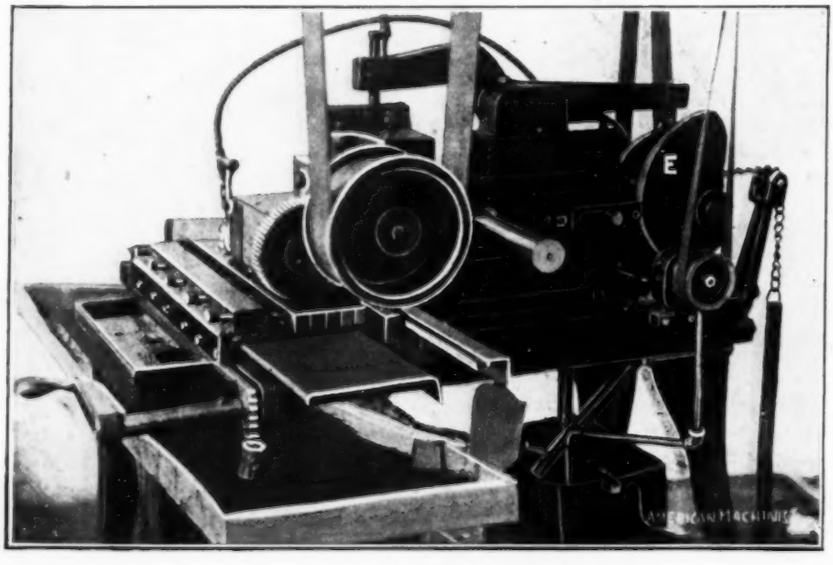


FIG. 2. CAM-FEEDING MECHANISM

timed that when the cutter *A* reaches the end of its cut, the finger *K* on the end of the lever drops off of the end of the cam rise *L*, letting the springs in the head force it up, raising the cutter clear of the work, at the same time cam *E* allows the ram to draw back.

The Indexing Mechanism

The cutter is now in position for the racks to be indexed for the next cut, which is done by the cam *M* striking finger *N*, which draws up the lock pin *O* and leaves the ratchet wheel *P* free to be moved the correct distance by dog *R*, which gets its movement from cam *S* striking a plunger, not shown, which causes rocking lever *T* to force the plunger *U* upward. This action of the dog turns the ratchet wheel *P* and through it a pinion on the other end of the same shaft, which meshes with a rack on the work table, and moves it along the space of one tooth of the racks being cut.

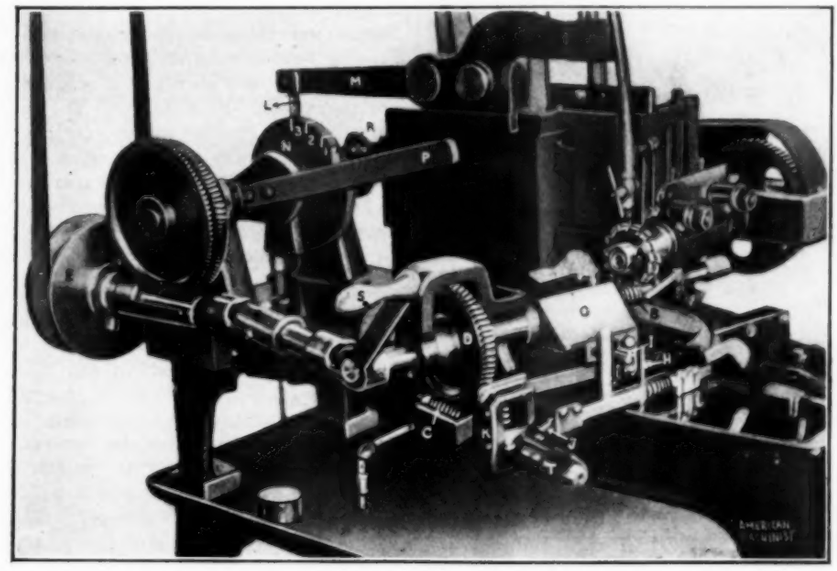


Fig. 3. Automatic Worm Miller

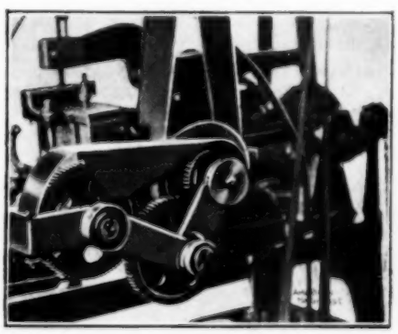


Fig. 4. Gear Drive for Cutter Spindle

The lock pin *O* now drops back into place, the cutter head is forced down by the rise on cam *J*, which moves the lever *I*; the ram is forced forward by cam *E* and the cutter starts on another cut, the contact pin *V* on the end of lever *I* riding on the hardened piece *W* as the ram is forced forward, the contact pin on the other end of the lever riding at rest on the cam *J*.

Cam Movement of Ram

Referring now to Fig. 2, the action of cam *E*, previously mentioned, on the ram will be at once seen. This cam, of course, only gives the forward movement, as the ram is pulled back by the spring and chain, as shown.

An ample amount of oil or other lubricant is supplied to the cutter by the pump shown just in front of the cam, which draws its supply from a tank beneath the machine.

The Worm Miller

The worm miller is an adaptation of the machine just described, and is shown in Fig. 3. The ram is locked and only vertical motion allowed the cutter head, the spindle of which has a slightly different drive from that of the rack cutter.

As a double-thread worm is being cut in the machine, two cutters are used at *A*. The worm *B* is rotated by means of the worm and gear *C* and *D*, which are driven direct from the pulley *E* by the universal jointed shaft *F*.

The worm being cut is also fed along by a master worm on the spindle underneath the guard *G*, the length of feed being regulated by the stop pin *H*, which is carried along the pin *I* until latch *J* allows the bracket *K* to drop down, throwing the worm *C* out of mesh with the gear *D*, and consequently stopping the feed.

Roughing and Finishing Worms

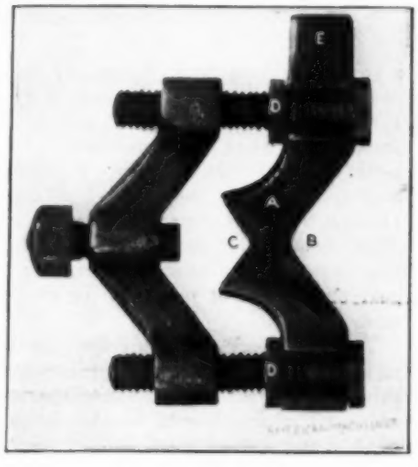
Three cuts are taken to finish a worm, the first cut being started with the contact pin *L* of lever *M* on the space marked 1 on cam *M*. With the pin *L* in position 1 the work is fed under the cutters until the feed is tripped, then the lever *P* is rocked back until the pin *L* drops into the cam at *R*; next the work spindle is run back by turning the handle *S*; the cam is rocked back until the pin *L* rests in position 2; the feed is thrown in by pulling up on handle *T* and the second cut finished, and when this is done the work is brought back to the starting point as before and the third and last cut taken with the pin *L* in position 3, as shown in the halftone.

Fig. 4 shows the gear train used to drive the cutter spindle for worm milling, so that a tight belt and perfect gear-tooth contact are obtained at all times.

Very rapid work can be done with this machine, as a boy or unskilled workman can run several machines with but little instruction after they have been set up for him.

A Grinder Dog

The halftone shows a new grinder dog which has been placed on the market by Thomas S. Barter, 1 Holt avenue, Worcester, Mass. In this dog the jaw *A* is reversible, so that either the large V



A Grinder Dog

B or the small one *C* can be adjacent to the setscrew; this enables one dog on the smaller sizes of work to handle the work usually requiring two dogs. In the larger work one dog will handle a wide variety of sizes.

The check nuts *D* hold the reversible jaw *A* securely, and prevent change of size. The driving pin of the grinder contacts with the projection *E*. The setscrew is brass-tipped to avoid marring the work, and in the three larger sizes the jaws are brass lined for the same reason. The dogs are made in four sizes: 1½, 2½, 4 and 7 inches, and each dog will hold work from ¼-in. diameter up to its nominal capacity.

Engine Lathe with Feed Change Gear in Apron

The illustrations show the all-gear feed lathe recently brought out by the Von Wyck Machine Tool Company, Cincinnati, Ohio.

This lathe is built in two sizes, namely 15- and 16-inch, and has under the head a gear box giving three changes of feed, controlled by the two levers seen in Fig. 1, while five other changes for each of these three rates are conveniently obtained through the medium of a gear mechanism in the apron, making in all 15 rates of feed through the gear boxes. This number is extended for either finer or coarser feeds by changing a gear on the end of the screw or on the stud.

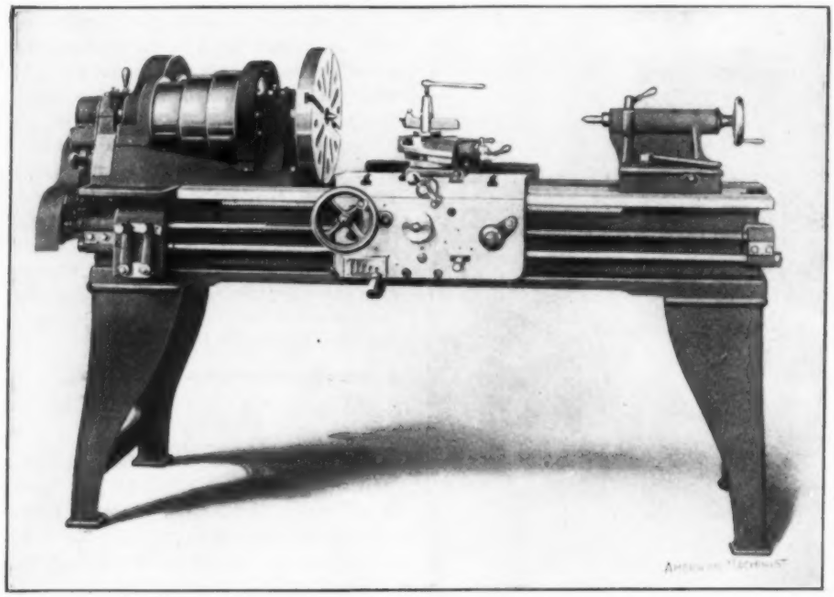


FIG. 1. 16-INCH LATHE WITH FEED-CHANGE GEAR IN APRON

The headstock and carriage are of rigid design and the hollow-crucible-steel spindle is formed with large bearings running in phospher-bronze boxes. Double back gears are provided which are in the ratios of 12 to 1 and 3½ to 1, and all gears are covered with suitable guards. The largest step of the driving cone is 10½x3⅛ inches.

The apron is of double-wall construction, as seen in Fig. 2, which shows it from front and rear. The apron drive is taken from the feed rod by the feathered gear *A*, which drives gear *B* and—through tumbler gears—the cone of five gears shown. This gear cone is independent of gear *A* and is feathered on the long hub of a quill which is formed with feed-reversing bevels on the ends and which slides in a supporting bracket when operated by the reversing handle shown near the lower left-hand corner of the apron. The feed rod with this construction is given two extra bearings and the rod and gears are thus rigidly supported.

The handle for shifting the tumbler gear into engagement with the required gear in the cone for any desired feed is placed conveniently at the lower edge of the apron and the pin in this handle in conjunction with the guide grooves enables the tumbler to be shifted and locked instantly.

The yoke which slides the feed-reversing gears in the apron, as indicated in the inside view, Fig. 2, also controls a device at *C* which prevents the nut for the lead screw from being closed on the screw except when the feed gears are in neutral position. Thus the friction feed and the lead screw cannot be engaged at the same time.

A chasing dial in the apron permits threads to be cut without stopping the lathe or reversing the lead screw, and no backing belt is needed. The cross-feed screw is provided with a dial reading to one-thousandth of an inch. The tailstock is so constructed that the compound rest may be swung at right angles. The reverse plate for the change-gear train is carried as shown, at the end of the head.

New Industrial School

The new Wentworth Institute, of Boston, stated to be the most extensive development in trade teaching and industrial education yet proposed, formally opened its doors on September 25.

It was to offer opportunity for young men to train themselves to be efficient workers in trades requiring skill and intelligence that Arioch Wentworth, a citizen of Boston, Mass., determined to devote the greater part of his fortune. By his will, something over $3,500,000 has been made available to endow a school whose purpose is "To furnish education in the mechanical arts."

The special aim of the institute is to teach trades and to train young men to be foremen and superintendents in building construction and in manufacturing industries. A modernly equipped machine shop is to form one of the important departments, the part time, or cooperative plan, is to have a place in curriculum, and the tuition fee is to be so nominal as to make the school practically a free one. There are to be day and evening courses, carrying a tuition fee of six dollars per term and six dollars a season of two terms, respectively.

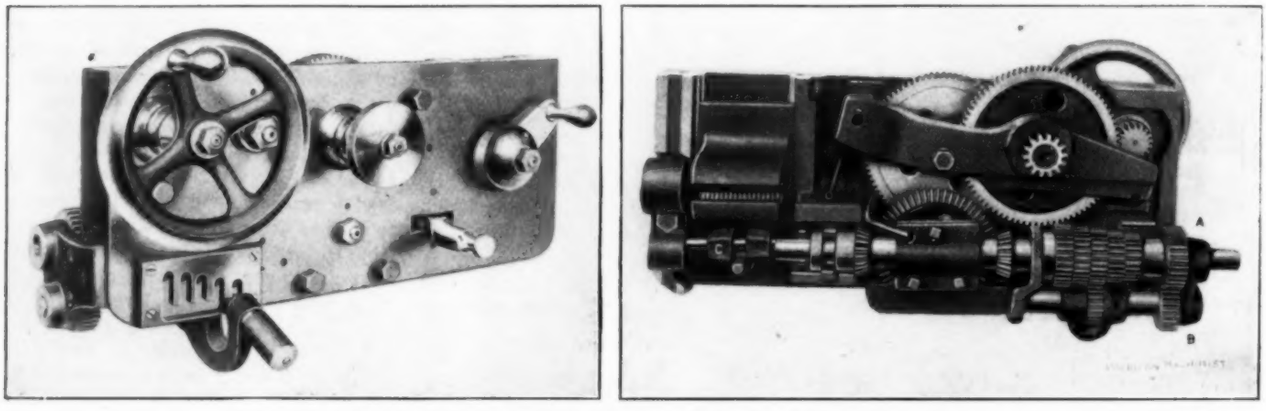


FIG. 2. APRON CONSTRUCTION AND DETAILS OF THE DRIVE

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

F. P. Gilson, of Machias, Me., is to erect an uptodate garage.

The Bangor Motor Company is erecting a large garage on Main street, Bangor, Me.

The plans for the E. D. Blaisdell Company's Dexter, Me., garage, have been accepted and work commenced.

Fire destroyed machine shop, blacksmith shop, etc., at the lumber plant of W. G. & L. H. Chase, Plymouth, N. H.

The City Coal Company, Hartford, Conn., will erect a garage at the corner of Garden street and Homestead avenue.

P. J. Russell has taken out a permit to erect a commercial garage at 33 Broad street, Springfield, Mass., to cost $6000.

Edwin Perkins has taken out a permit to erect an automobile garage and paint shop at 28-30 Mason street, Springfield, Mass., to cost $8000.

The Ernest P. Chesbro Garage Company, Willimantic, Conn., will erect a new building to be used as a repair shop in addition to its garage on Main street.

H. D. Smith & Co., Plantsville, Conn., are in the market for heavy back-geared press of 4 to 5 tons weight, length of stroke, 2 inches, with opening in bed small.

The National Metallic Bed Company, Everett, Mass., has been incorporated to manufacture metal beds. Capital, $20,000. Incorporators, Herman Rosenthal, Frank A. Yanes, of Chelsea; John W. Wilkes, Brookline.

Meriden Press and Drop Company, of Meriden, Conn., has been incorporated to make and build presses, tools, etc. Capital, $500,000. Incorporators, Herman Hess, Henry Doolittle, C. H. Doolittle and R. P. Hess, of Meriden.

Standard Scale and Equipment Company, of New Haven, Conn., has been incorporated to make and deal in scales, trucks, etc. Capital, $10,000. Incorporators, J. Hypkin Brown, Thomas Eden and Charles W. Allen, all of Bridgeport.

MIDDLE STATES

Renz Motor Car Sales Company, Cleveland, Ohio, will build a garage.

The Boston & Maine railroad may erect a car-repair shop at Mechanicsville, N. Y.

The Teling Brothers Company, Cleveland, Ohio, has let contracts for a large garage.

The Pennsylvania lines are planning to build a new roundhouse at Hartford City, Ind.

The Michigan Steel Castings Company, of Detroit, Mich., is to erect some new foundries.

Hyatt Roller Bearing Company, Newark, N. J., will build a large addition to its factory.

George S. Mitchell, manufacturer of brass goods, will erect a new factory in Cleveland, Ohio.

J. Hutchison has let contract for a two-story garage at Woodbury, N. J., to cost $20,000.

Climax Road Machine Company, of Marathon, N. Y., will establish a factory at Hamilton, Ont.

The Western Steel Car and Foundry Company, Hegewisch, Ill., will build a one-story machine shop.

The Marion Automobile Company, Dayton, Ohio, will equip a commercial garage. B. Eaton, owner.

A. B. Price has let contract for a three-story garage at 3431 Ludlow street, Philadelphia, Penn.

H. Rybolt, furnace manufacturer, Indianapolis, Ind., will erect a new factory at 629 North East street.

M. Dannenbaum has let contract for a two-story garage at Third and Diamond streets, Philadelphia, Penn.

The Victor Motor Truck Company has broken ground for its new factory at Black Rock, Buffalo, N. Y.

The American Foundry Company, Indianapolis, Ind., will erect a new factory building in Warren street.

The Hupp Motor Car Company, of Detroit, Mich., manufacturer of the "Hupmobile," is to erect a new factory.

The Republic Metal Ware Company, Buffalo, N. Y., is building an addition to its plant at a cost of $38,000.

The Rieger & Gretz Brewing Company has plans posted for a large garage at Oxford and Germantown avenue, Philadelphia.

The Niagara Machine and Tool Works, Buffalo, N. Y., has in course of construction a four-story addition to its plant.

The American Brass and Iron Company, of Detroit, Mich., manufacturing brass and iron girders, is to erect a new factory.

The Thomson Coats Company, Lawrence street, Newark, N. J., manufacturing automobile supplies, will erect a factory.

J. W. Rosenberg has let contract for a two-story garage at 207 to 209 North Broad street, Philadelphia, Penn., to cost $15,000.

The Edwards Steam Specialty Company, 2128 West Forty-ninth place, will build a one-story factory and add new tools.

The machine department of the Forest City Furniture Company, Rockford, Ill., was damaged by fire to the extent of $10,000.

The Milwaukee (Wis.) Concrete Mixer and Machinery Company is planning to erect a $50,000 plant for making its machines.

The Lawrence Gas Fixture Company has let contract for an addition to its plant at Thirteenth and Arch streets, Philadelphia.

The Buhl Stamping Company, of Detroit, Mich., manufacturer of metal stampings, is to erect a large addition to its present plant.

Camden Garage and Auto Company has opened a new shop at 41-43 Camden street, Newark, N. J. Will increase its shop capacity.

The Philadelphia (Penn.) Textile Machinery Company has secured site at Sixth street and Tabor road on which a new plant will be erected.

The American Railway Supply Company will erect a factory at Charles and Greenwich streets, New York, for the manufacture of brass tags.

The Whitesides Motor Car Company, manufacturing commercial trucks, is preparing to move its factory from Franklin, Ind., to Newcastle, Ind.

Rauch & Lang Company, manufacturer of electric automobiles, Cleveland, Ohio, will erect a new factory building on West Twenty-fifth street.

M. Gould's Son Company, Newark, N. J., manufacturing trunk hardware, will erect a four-story addition to its plant at 61 Hamilton street.

The Remington Typewriter Company will proceed immediately with the erection of a six-story east wing addition to its Ilion, N. Y., plant.

The Rochester Stamping Company, manufacturer of tinware, at Rochester, N. Y., will erect an addition to its present factory at a cost of $30,000.

The Fireproof Storage Company, Cleveland, Ohio, will build a four-story storage plant and auto garage to cost $100,000. Plans have been completed.

The Cuyahoga Motorcycle Company, of Cleveland, Ohio, has been incorporated to manufacture motorcycles, by G. L. Hogenbuck, H. A. Blyth, etc.

The North Tonawanda Musical Instrument Works will erect additions to its plant at North Tonawanda, N. Y., in the near future, at a cost of $50,000.

The Penton Press Company, of Cleveland, Ohio, has been incorporated to manufacture presses. H. T. Clark and Sterling Newell, principal stockholders.

Keith Car Company, Chicago, Ill., has been organized with $15,000 capital to manufacture railroad cars by O. S. Keith, Guy S. Sowerby, John T. Wilson.

The Alvey-Ferguson Company, manufacturer of power conveying machinery, is building shops at Oakley, Ohio, and will remove its plant from Louisville, Ky.

The Bauroth Machine Company, Toledo, Ohio, has changed its name to Bauroth Machine and Stamping Company. A metal-stamping department will be added.

Triumph Bed Spring Company, Chicago, Ill., has been organized with $5000 capital to manufacture patent bed springs, by Pacar Rebe, Frank Smith, Albert C. Benson.

The Geo. F. Mitchell & Son Company will erect a factory at Cedar avenue and East Sixty-fifth street, Cleveland, Ohio, for the manufacture of sheet brass goods.

The Packard Motor Car Company, of Detroit, Mich., has leased a building in Cleveland, Ohio. Full equipment will be installed for the care and repair of its cars.

The Lanston Monotype Machine Company has let contract for the erection of a six-story factory at Twenty-fourth and Locust streets, Philadelphia, Penn., to cost $250,000.

The Dixon Cascade Pump Company, Newark, N. J., will erect a new plant at Badger avenue and Runyon street. About $10,000 will be expended for new equipment.

The Illinois Central is proceeding with the construction of a new roundhouse at Cham-

paign, Ill. Machine shops, power station, coal chutes, etc., are also to be constructed.

The La Porte (Ind.) Radiator Company has been incorporated with $100,000 capital to manufacture radiators, etc. Incorporators, Emmet Scott, A. J. Rumely, Vance Wilkins.

Klosmove Fence and Manufacturing Company, Metropolis, Ill., has been organized with $2400 capital to manufacture wire fence, by C. E. Trovillion, R. Matthews, I. T. Kimball.

The Zaremba Company, Buffalo, N. Y., has leased a factory building at Elk street and the Buffalo Creek railroad and will equip same for the manufacture of evaporators, etc.

The Buffalo Steam Pump Company has purchased the old plant of the Tonawanda Sectional Boiler Company, at North Tonawanda, N. Y., and will include it as part of its plant.

The Maclean Foundry Company, Upper Sandusky, Ohio, has been organized to do a general foundry business by Charles E. Shale, H. Von Blon, A. B. Whitney, etc. Capital, $80,000.

Richards' Hardware and Specialty Company, Aurora, Ill., has been incorporated with $100,000 capital to manufacture hardware, etc., by W. S. Cumming, Henry M. Hobson, William J. Pringle.

The Indiana Gas Engine Company, Indianapolis, Ind., has been organized to manufacture and repair gas engines. Capital, $25,000. Incorporators, G. O. Westerfield, J. W. Connaty, S. S. Brewer.

Canton Corrugating Company, Canton, Ohio, has been organized with $100,000 capital to manufacture corrugated, stamped and pressed metal products of all kinds by H. L. Raley, Everett L. Mills, etc.

The Michigan Auto Joint Company, Grand Rapids, Mich., has been organized with $10,000 capital to manufacture universal joints and automobile accessories by C. E. Perkins, F. Carter, etc.

The Dayton & Troy Automobile Company, Dayton, Ohio, has been incorporated with $10,000 capital to operate a sales agency, garage and repair shop by C. E. Lemerick, S. S. Faulkner, W. J. Sherer, etc.

The United Railway Appliances Company, Salamanca, N. Y., has been organized with $100,000 capital to manufacture railroad appliances and supplies. Incorporators, J. Harvey, C. Paul, J. E. Maloney.

The Kenton Appliance Company, Kenton, Ohio, has been organized to manufacture and deal in gas, electrical and mechanical appliances by Charles R. Price, J. A. Baird, Harry Steffen, etc. Capital, $10,000.

A. Bolognesi, a banker of 52 Wall street, New York City, will erect in Poughkeepsie, N. Y., to be ready to operate next spring, a factory to manufacture carbureters, radiators and othe automobile accessories.

Pryne Manufacturing Company, Cleveland, Ohio, has been organized with $12,000 capital to manufacture and repair tumbling bands and iron wire and metal work by M. Zeman, M. F. Zeman, Emanuel Heibal, etc.

Sanitary Suction Cleaner Company, Chicago, Ill., has been incorporated to manufacture vacuum cleaners and sanitary devices, etc., by Agnes Lamb, Jesse Lowenhaupt, Charles Lewiston. Capital, $25,000.

Hershell-Spillman Company, North Tonawanda, N. Y., is erecting an addition to its plant, which will be used in the manufacture of gasolene engines. The building will be completed in from two to three months.

Cincinnati Patent Pulley Manufacturing Company, Cincinnati, Ohio, has been organized with $10,000 capital to manufacture patented pulleys and machinery by Emil W. Kottusch, Adolph A. Gruber, John H. Bischof, etc.

The Bliss Sanitary Garbage Can Company, Grabill, Allen county, Ind., has been incorporated with a capital of $40,000 by John Haifley, J. B. Henry, Joseph Wittmer, C. A. Bliss and others, to manufacture garbage cans.

The Cuyahoga Motorcycle Company, Cleveland, Ohio, has been incorporated to manufacture and deal in bicycles, motorcycles and automobiles, by George E. Hagenbuch, H. A. Blythe, William G. Stuber, etc. Capital, $10,000.

The Spring Hub Automobile Wheel Company, Cincinnati, Ohio, has been incorporated to manufacture automobile and other vehicle wheels. Capital, $10,000. Incorporators, James G. Blackburn, John H. Kruse, Harry T. Earle, etc.

The Huffman Traction Engine Company, of Leipsic, Ohio, has been incorporated with a capital of $50,000 to manufacture all kinds of traction engines by S. H. Huffman, W. H. Huffman, J. S. MacLean, O. R. Huffman and G. S. Huffman.

The Buckeye Implement and Supply Company, Cleveland, Ohio, has been incorporated with $10,000 capital to manufacture and repair all kinds of farm implements, hardware and supplies by C. R. Cross, E. C. Mullen, M. A. Rusch, etc.

The Cleveland Welding and Manufacturing Company, Cleveland, Ohio, has been organized with $150,000 capital to do all kinds of welding by electrical or other process. Incorporators, E. S. Heinshaw, H. J. Holden, C. D. Sword, etc.

The Brooks-Kleinschmidt Typewriter Company, New York, has been incorporated to manufacture typewriters, telegraph instruments, etc. Capital, $50,000. Incorporators, Byron Brooks, 111 Broadway; Edward Kleinschmidt, 231 Greenwich street, etc.

The Monroe Calculating and Recording Machine Company, New York, has been incorporated to manufacture calculating and recording machines. Capital, $50,000. Incorporators, J. R. Monroe, East Orange, N. J.; F. S. Baldwin, Brooklyn; H. G. Deehant, New York.

The Engineering Products Company, Detroit, Mich., manufacturing electrical specialties, has moved into its new plant on Goldsmith avenue, near the Michigan Central railroad and is in the market for equipment, including lathes, drill presses, milling machines, planer, power hack saw, etc.

The General Automatic Company, of Syracuse, N. Y., has been incorporated with $250,000 capital to make and sell cash registers and cash-assorting machines. The promoters state that work will begin on a factory in Syracuse, Jan. 1. Directors: Cecil B. Cory, Edward J. Richardson, Warren S. Barlow, etc. It is understood that the corporation will succeed the Premier Automatic Cashier Company, a Pennsylvania corporation, and will manufacture automatic devices under patents held by associates in Pennsylvania.

SOUTHERN STATES

The Louisville & Nashville Railroad Company will increase the capacity of its shops at Boyles, Ala., and will purchase new equipment.

The Southern Combing and Ginning Company, of Chattanooga, Tenn., is planning to locate a plant in Georgia for the manufacture of combing gins.

WEST OF THE MISSISSIPPI

The Pacific Electric Railway Company, Los Angeles, Cal., has acquired a large tract of land near Dominguez, and is said to be planning for the erection of large car shops for repair work.

The Honeyman Hardware Company, Portland, Ore., has acquired a large tract of land and is having plans prepared for a new plant. Modern equipment will be installed. D. C. Lewis, Portland, is architect.

Modern repair shops will be installed in the new State armory building to be erected at San Francisco, Cal. The building is estimated to cost $500,000. A. G. Scholz, architect, San Francisco, is preparing plans.

The Jordan-Christ Hardware Company, Sacramento, Cal., has been incorporated with a capital of $75,000 to manufacture hardware specialties. L. E. C. Jordan and E. T. Christ are interested in the company.

The Capital Gas Engine Company, Sacramento, Cal., has been incorporated with a capital of $100,000. The company plans for the erection of a plant near Sacramento, for the manufacture of a patented gas engine. James Shaw is head of this organization.

The Balfour-Guthrie Company, Seattle, Wash., has let the contract for the erection of a large machine shop to be used in connection with its proposed cement-manufacturing plant, at Belingham, Wash. The building will cost $20,000 and will be completely equipped with necessary machinery.

The Dickerson Automatic Governor Company, Salt Lake City, Utah, recently organized, plans for the erection of a plant for the manufacture of a patented automatic hydraulic governor, for hydraulic and steam control. Arthur Dickerson, American Fork, Utah, is head of this company.

CANADA

The French's Complex Ore Reduction Company, Ltd., will erect shortly in Nelson, B. C., a plant for the treatment of zinc ores. A factory is also to be built for the making of dry batteries from the zinc and black manganese oxide produced, and a third plant is to be installed for the making of zinc pigment from the pure metal saved from the ores.

FOREIGN

The Britannia Engineering Company, 165 Main street, St. Johannesburg, S. A., would like catalogs and prices on the following machine tools: Medium size planing machines, radial drills, universal milling machines, keyseaters, open-side planer, machine for milling keyways in shafts.

GENERAL MANUFACTURING

NEW ENGLAND

The Bates Manufacturing Company (cotton goods), Lewiston, Me., is to enlarge its plant.

The plant of the Archibald Wheel Company, Lawrence, Mass., was burned. Loss, $60,000.

The New Haven (Conn.) Gas Light Company will build an addition to the pump house.

M. T. Stevens & Sons Company, Haverhill, Mass., is having plans prepared for a new dyehouse.

Julian Florian will establish a modern laundry in Southington, Conn., in the near future.

G. L. Nesbit will build a two-story garage on Brown street, New Haven, Conn., to cost $8000.

Sydney Blumenthal & Co., Shelton, Conn., are erecting a new power house for their No. 1 mill.

The plant of the Seacoast Canning Company, at Eastport, Me., was destroyed by fire. Loss, $60,000.

The plant of the Friedrich Dyeing Company, Woonsocket, R. I., was destroyed by fire. Loss, $50,000.

The Tallyho Knitting Company, manufacturer of sweaters, is to locate a factory at East Douglas, Mass.

The T. E. Mains & Son Company, Moosup, Conn., is to enlarge its engine room and will install a new 35-horsepower gasolene engine.

The Ware Electric Company, Ware, Mass., will issue $40,000 additional stock, part of which will be used for the extension of its plant.

The Merrick Lumber Company has acquired a building on Maple street, Easthampton, Mass., which wil be equipped for a woodworking plant.

J. F. Hale, president of the Hale Piano Company, contemplates purchasing and equipping a factory at East Douglas, Mass., for the purpose of manufacturing pianos.

The Derby (Conn.) Gas Company will erect three new buildings in Shelton, consisting of a condenser house, a retort house and coal bin. L. W. Robinson, New Haven, architect.

Power-plant equipment will be required for the new hotel to be erected in Worcester, Mass., by a recently formed corporation of which Charles L. Allen, of Worcester, is president . Estimated cost, $700,000. Esenmein & Johnson, Buffalo, N. Y., are the architects.

MIDDLE STATES

The town of Ferdinand, Ind., will build a waterworks plant.

The Defiance (Ohio) Carriage Company will build a new plant.

The Cheney Piano Action Company, Castleton, N. Y., is enlarging its plant.

The Langsenkamp-Wheeler Brass Works, Indianapolis, Ind., will install a boiler.

Rochester, N. Y., will expend $100,000 for improvements to its waterworks system.

The Utica Steam Engine and Boiler Works, Utica, N. Y., is erecting a new boiler shop.

The Forest City Brewing Company, Cleveland, Ohio, will make additions to its plant.

The city of Milwaukee, Wis., will erect a $59,000 power house adjoining the garbage incinerator.

The city of Anderson, Ind., is in the market for a turbine generator for the electric-light plant.

Fire destroyed the plant of John C. Dietz & Co., desk manufacturers, Cincinnati, Ohio. Loss, $75,000.

The plant of the National Packing and Pickling Company, Knox, Ind., was burned. Loss, $20,000.

The dye works of K. Slaughter, of Ontario and Hartwell street, Philadelphia, was destroyed by fire.

The Toledo Belting Company, Toledo, Ohio, incorporated to make line of belting. John Stolker is manager.

The Stecher Lithographing Company, Rochester, N. Y., is planning an $80,000 addition to its present plant.

The Bayless Pulp and Paper Company is planning to rebuild its mill at Austin, Penn., recently destroyed by flood.

The C. H. Lynch Shoe Manufacturing Company is putting up a four-story addition to its factory at Poughkeepsie, N. Y.

The packing plant of Sulzberger & Sons, Ashland and West Forty-First street, Chicago, was badly damaged by fire. Loss, $50,000.

The Fairfield Canning Company, of Amanda, Ohio, has been incorporated to do a general canning business by Joseph Reichelderfer, etc.

The Milwaukee (Wis.) Electric Railway and Light Company will erect a boiler shop and coal bunkers at its shop on Cold Spring avenue.

The Handy Wagon Company, Des Moines, Iowa, manufacturing silos, will erect an addition to its plant at Eighth and Murphy streets.

The Peru (Ind.) Basket Company has been incorporated with a capital of $30,000 by G. R. Chamberlin and others to manufacture baskets.

The Children's Memorial Hospital Company, Chicago, Ill., will build a three-story building at 725-35 Fullerton avenue, and equip it with a power plant.

The Fels Soap Company has let contract for a five-story addition to its plant at Island road and Woodland avenue, Philadelphia, to cost $50,000.

The Nevins-Church Press Company, Irvington, N. Y., is planning to enlarge its plant for the manufacture of cigarette boxes and expects to employ 200 additional hands.

The Mohawk Silk Fabric Company, of Fultonville, N. Y., has leased a building in Schenectady, N. Y., where it will make up its product into silk gloves and underwear.

The Federal Rubber Manufacturing Company, Chicago, Ill., has been incorporated with $10,000 capital to manufacture rubber goods by A. W. Underwood, Chas. R. Young, A. A. Basse.

The Ohio Top Company, Cincinnati, Ohio, has been organized with $25,000 capital to manufacture tops for automobiles, buggies and launches by Robert F. Kroger, William Bossemeyer, Bion Place, etc.

The C. W. Haas Tire Seal Company, Chicago, Ill., has been organized to manufacture rubber tires, automobile accessories, etc. Capital, $75,000. Incorporators, C. W. Haas, R. C. Ukenga, Emmett C. May.

The flour mill at Pittsford, N. Y., which has been operated by Eugene S. Berry, has been sold to Troy and Lockport interests, and it is planned to increase the capacity of the mill from 100 to 300 barrels a day.

The Diamond Paper Box Company, Rochester, N. Y., has been organized with $10,000 capial to manufacture card and paper novelties. Incorporators, Chas. D. Camp, Harry D. Moech, Julius N. Thiels, all of Rochester.

The E. I. Du Pont de Nemours Powder Company has purchased a tract of land of about 100 acres on the west bank of the Mohawk river, near Cohoes, N. Y., and it is understood will erect a powder mill on the property.

The Muessel Brewing Company, South Bend, Ind., will more than double the capacity of its plant. A new building to cost $30,000 will be erected. Other improvements and changes in buildings now standing will cost $100,000.

The Ferdinand Railroad Company, Ferdinand, Ind., has been incorporated with a capital of $60,000 by Henry Beckman, J. A. Souderman and others to operate the Ferdinand railroad between Huntingburg (Ind.) and Ferdinand.

The Terre Haute (Ind.) & Ohio River Railroad Company has been incorporated at Olney, Ill., with a capital of $160,000. The company will build a railroad from a point in Illinois, opposite Terre Haute, Ind., to Elizabethtown, Ill.

The Indiana Service Company, Anderson, Ind., has been incorporated with a capital of $10,000 by Clement W. Hooven, Howard L. Otis, John T. Bacon and others. The new company will supply electricity to neighboring Indiana towns.

The Terre Haute & Ohio River Railway Company, Chicago, Ill., has been incorporated with $100,000 capital to build and operate a railroad. Incorporators, Philip L. Casford, 438 Belden avenue; Geo. Von Reinolts, 4853 North Winchester avenue, etc.

The Jay Street Cold Storage Company, New York, has been incorporated to conduct a cold-storage warehouse. Capital, $10,000. Incorporators, B. Waldman, 78 South Tenth street, Brooklyn, N. Y.; Jacob Gensler, Samuel J. Cohn, 39 Liberty street, New York.

George C. Christleib, of Wheeling, W. Va., has completed arrangements for the erection of a $100,000 brick plant for the Summit Brick Company, at Summitville, Columbiana county, Ohio. The plant will have twelve 30-foot kilns and a capacity of 40,000 daily.

The Clark Paper and Manufacturing Company, Rochester, N. Y., has purchased four acres of land on Dewey avenue, that city, and will erect four buildings for occupancy next year. With the removal it expects to increase its output and the number of hands employed.

The Hayes Knitting Company has been incorporated at Oswego, N. Y. Capital, $30,000. Will manufacture hosiery, underwear, etc., using the factory formerly occupied by the Oswego Knitting Company, closed some months ago. The new company will employ about 100 hands.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids November 14, for steel and brass bolts and nuts, steel boiler rivets (schedule 4042), steel hull rivets, steel plate washers, bar brass (schedule 4037), bar steel, steel shapes (schedule 4036), pipe fittings (schedule 4041), brass valves (schedule 4040).

Proposals will be received until 10 a.m., December 4, at the headquarters, Philippines division, officer in charge of defensive works, Manila, P. I., for condensers, pumps, feed-water heater, forced-draft fans, engines, generators, converters, transformers. Full information can be had of Chief of Engineers, United States Army, Washington, D. C.

SOUTHERN STATES

Kingstree, S. C., will issue $22,000 bonds for improvements to its waterworks and sewer systems.

Fire destroyed the plant of the Ashland Leather Company, Ashland, Ky., recently. Loss, $125,000.

Colonial Beach, Va., will issue $37,000 bonds for improvements to its waterworks and sewer systems.

Plans are being prepared for a two-story knitting mill for the Gilreath Manufacturing Company, Greenville, S. C.

The power plant of the P. Hagerty shoe factor yat Washington, C. H., Ohio, was badly damaged by a flywheel explosion.

The H. C. Wood Company, of Madisonville, Ohio, will build a new $50,000 plant at Wyoming, Ohio, for the manufacture of artificial ice.

A large modern electric power plant will be built by the Chesapeake & Ohio Railway Company, at Covington, Ky., to supply current to its shops.

The Cincinnati Traction Company has taken out a permit for the erection of a new one-story brick boiler house on Keck street, Cincinnati, Ohio.

A new planing mill is being built by the Chesapeake & Ohio Railway Company, at Silver Grove, near Newport, Ky., for which considerable new equipment will be required.

WEST OF THE MISSISSIPPI

M. E. Bise, Corcoran, Cal., plans for the installation of a pumping plant.

John Purcel, Porterville, Cal., contemplates the installation of a pumping plant.

Dustin, Okla., will issue $25,000 bonds for improvements to its waterworks system.

The Arcadia (Neb.) Coöperative Creamery Company will erect a modern creamery.

W. E. Keller, Galwa, Cal., contemplates the erection of a modern pumping plant.

The Des Moines (Iowa) Central Heating and Power Company will rebuild its plant.

The city of Gresham, Ore., has voted bonds for the installation of a waterworks system.

Bryan, Texas, will issue $15,000 bonds for improvements to its lighting and water systems.

The Twin City Woodworking Company, Chehalis, Wash., wil rebuild plant recently burned.

The Baker White Pine Company, Baker City, Ore., is erecting a building to be used as a box factory.

The Home Water and Power Company, Mt. Vernon, Wash., plans for the erection of a cold-storage plant.

The J. F. Cullen Company, San Diego, Cal., will install a waterworks system on its property at Cardiff, Cal.

The California-Coalinga Oil Company, near Coalinga, Cal., plans to install new machinery for oil drilling.

The Sierra Power Company, Riverbank, Cal., will build a new electric power substation in this dsitrict.

The Home Telephone Company, Medford, Ore., plans for the installation of a plant and system at Ashland, Ore.

The Old People's Home, Pierce street, San Francisco, Cal., has taken out a permit to build a new boiler plant.

The Pacific Telephone and Telegraph Company, Los Angeles, Cal., will build a new exchange plant at Colton, Cal.

The Penrod Walnut and Veneer Company, of Kansas City, Mo., will locate a $75,000 plant in West Helena, Ark.

Kerschbraun & Sons, of Omaha, Neb., are seeking a site for a branch creamery at Holdrege, Neb., to cost $20,000.

F. Glasmacher, Auburn, Wash., will build a modern shoe-manufacturing plant. The plant will be fully equipped.

The Fulton Oil Company, Maricopa, near Bakersfield, Cal., will install new oil-drilling machinery in the near future.

Armour & Co. wil build an addition to its plant at Aberdeen, S. D., to consist of cooler, refrigerator and freezing rooms.

The city of Falls City, Ore., has voted bonds for extensions and improvements in the municipal waterworks system.

In connection with its new waterworks system the city of Wapato, Wash., will soon ask for bids on pumping machinery.

The Phœnix lumber mill, Seattle, Wash., was destroyed by fire, with a loss of $40,000. Wm. Batley is head of this company.

The Dutch mine, near Big Oak Flat, Cal., plans for the installation of new air compressor and electric hoisting machinery.

The Pacific Light and Power Corporation, Los Angeles, Cal., will build an addition to its transformer station at Mentone, Cal.

A new condenser will be installed in the municipal light, power and water plant at Palo Alto, Cal. P. Boland, chief engineer.

The C. Ganahl Lumber Company, Redondo Beach, near Los Angeles, Cal., has taken out a permit to build an addition to its plant.

The lumber-mill plant of the Northwestern Lumber Company, Kalispell, Mont., was destroyed by fire. Loss estimated at $100,000.

The Florence (Ore.) Electric Company plans for the installation of a lighting and power system. A franchise has been asked.

The Portneuf-Marsh Valley Irrigation Company, Downey, Ida., will build a modern waterworks plant and system, near Downey.

The Bimel-Ashcroft Company, Poplar Bluff, Mo., is building a finishing department at its spoke factory to be equipped with modern tools.

The Beaver River Light and Power Company, Boise, Ida., plans for the installation of a lighting and power system at Twin Falls, Idaho.

The San Fernando (Cal.) Publishing Company is having plans prepared for a new publishing plant. Modern equipment will be installed.

The canning plant of the Holmes Company, East Eighth street, Portland, Ore., was partially destroyed by fire. The plant will be rebuilt.

The city of Spokane, Wash., plans for the purchase of a modern steam shovel to cost about $4000. City Engineer Macartney is interested.

The city of Myrtle Creek, Ore., is increasing the capacity of its municipal electric-lighting plant. The plant will be fully equipped.

The plant of the Coos Bay Eagle Brewing Company, Marshfield, Ore., recently destroyed by fire, will be rebuilt and new equipment installed.

The Algona Lumber Company, Pokegama, Ore., plans for the erection of a sawmill plant of 75,000 feet daily capacity at Klamath Falls, Ore.

The Fresno (Cal.) Water Company has taken out a permit to build a new power substation to be used in connection with its waterworks.

The Sierra & San Francisco Power Company, San Francisco, Cal., plans for the installation of a lighting and power system at Berkeley, Cal.

The Daisy mine, Diamondfield, near Goldfield, Nev., plans for the installation of new hoisting machinery. Albert McCoy is head of this property.

The Pacific Light and Power Company, Los Angeles, Cal., has taken out a permit to build a new transformer house at its Hollywood substation.

The Kern Mutual Telephone Company, Bakersfield, Cal., will build a new exchange plant at Maricopa, Cal. J. T. Maguire is interested in this company.

The Washington Fruit Lands and Irrigation Company, Othello, Wash., plans for the installation of electric pumping machinery near Priest Rapids.

The city of Madera, Cal., will install an auxiliary steam plant for its pumping plant at the city waterworks to provide against interruption in service.

The Yuma (Ariz.) Water and Electric Company has taken out a permit to build an addition to its electric power plant. Samuel DeCorse is superintendent.

The Anacortes (Wash.) Glass Company, glass manufacturer, has commenced work on doubling the capacity of its plant. New machinery will be installed.

The Pacific Fruit Package Company, Raymond, Wash., manufacturer of fruit boxes, will increase the capacity of its plant. New machinery wil be installed.

Tupper & Stevens, Auburn, Cal., have acquired property at Grass Valley, and will establish a modern creamery plant. Modern equipment will be installed.

The Wood Lumber Company, San Pedro (Los Angeles), Cal., is having plans prepared for a modern shavings crematory addition to its lumber plant.

The Imperial Valley Oil and Cotton Company, El Centro, Cal., plans for the erection of a cotton-seed oil-refining plant. Modern machinery will be installed.

The Starr Mill Company, La Center, Wash., has broken ground for a large sawmill plant, with a daily capacity of 100,000 feet. The plant will be fully equipped.

The San Ysidore Irrigation Company, San Diego, Cal., plans for the installation of a large pumping plant on the Tia Juana river. About $25,000 will be expended.

The city of Portland, Ore., will install a modern water system in the Sellwood district. About $129,000 will be expended. The city water board is in charge of this work.

The Pacific Telephone and Telegraph Company, San Francisco, Cal., plans for extensions in its telephone system in central Nevada. New plants will be established.

The Mint Gold Mining Company, Copper Basin district, near Prescott, Ariz., plans for the installation of new pumping machinery. Robert Mitchell is head of this company.

Dr. F. S. Pearson, 25 Broad street, New York, will erect a woodworking plant at El Paso, Texas, to cost $3,000,000. Lumber and planing mills will be erected as adjuncts.

The Kerman (Cal.) Telephone Company, recently organized, plans to install a 35-mile telephone system and central exchange plant in this vicinity. Jacob Mansar is president.

The Skamania Light and Power Company, Stevenson, Wash., contemplates the installation of a lighting and power system at Vancouver, Wash. A franchise has been asked.

The city of Blue Lake, Cal., has acquired water rights in Vaissaide creek, and plans for the installation of a modern waterworks system. K. Geer is interested in this work.

The city of Stockton, Cal., contemplates the installation of a municipal electric-lighting plant and underground conduit system. An election will soon be held for this purpose.

T. C. Torpey, Maricopa, Cal., contemplates the installation of a modern waterworks system to serve the community. A franchise has been asked. About $100,000 will be expended.

The Tulare County Power Company, Tulare, Cal., is building a large power plant near Globe, Cal. The erection will be completed in 1912 and machinery will then be installed.

The Miami (Ariz.) Electric and Power Company has been incorporated with a capital of $500,000 by C. W. and R. S. Van Dyke. The company will operate in this district.

The plant of the McGuire Cabinet Company, Los Angeles, Cal., manufacturer of show cases and wood fixtures, was destroyed by fire. Loss, about $15,000. The plant will be rebuilt.

The United States Cashier Company, Portland, Ore., manufacturer of cash registers, has taken out a permit to build a new boiler-room addition to its plant in the Kenton district.

John Bugbeder, Portland, Ore., is having plans prepared for a modern steam-laundry plant to be erected on East Sixth street. The plant will be fully equipped with necessary machinery.

The Highland Fruit Protective Association, Del Rosa, near Riverside, Cal., will build an addition to its fruit-packing plant. Modern machinery will be instaled. C. B. Monaghan is president.

The Mountain States Telephone and Telegraph Company, Salt Lake City, Utah, will build a new exchange plant in the Hyland district. George McCarn is general plant superintendent.

The Thousand Springs Power Company, Phœnix, Ariz., has been incorporated by F. N. Bancroft and J. J. Crippen, with a capital of $2,000,000. Head offices will be established at Denver, Colo.

The Great Western Power Company, San Francisco, Cal., plans to install a lighting and power system at Martinez, Cal. Permis-

sion has been granted for the erection of a plant in the city.

The California Door Company, Oakland, Cal., manufacturing doors and kindred products, plans for the removal of its plant to Richmond, Cal. The new plant will be increased in capacity.

The Skamania Light and Power Company, Stevenson, Wash., plans to install a lighting and power system at The Dalles, Ore. A franchise has been asked. Samuel Samson is head of this company.

The Minnesota & Ontario Power Company, International Falls, Minn., office at Minneapolis, is reported to be considering the duplication of its power plant, as soon as water-right troubles are adjusted.

The Northern California Oil Company, Orland, Cal., recently incorporated, has acquired oil property near Orland, and will install machinery for drilling operations. Lloyd Gay is head of this company.

The Inlaid Floor Company, San Francisco, Cal., whose woodworking plant was recently destroyed by fire, has taken out a permit to erect a new plant on Harrison street. Modern machinery will be installed.

The Utah Consolidated Oil Company, Bluff City, Utah, recently organized, plans for the installation of a complete equipment of machinery for oil-drilling operation. James G. Fitch is head of this company.

The city of San Francisco, Cal., has purchased property on Geary street, as a site for the electric power plant to be erected for the Geary Street Municipal railway. Plans for this plant will soon be prepared.

The Pacific Telephone and Telegraph Company, Portland, Ore., will make improvements and additions in its plants and system at Eugene, Cottage Grove, Roseburg and Albany, Ore. About $75,000 will be expended.

The Sunset Beach Gas and Electric Company, Los Angeles, Cal., has been incorporated by C. W. Gower, F. W. Norman and H. A. Pierce, with a capital of $25,000. The company will operate in this section.

The Petaluma (Cal.) Ice and Cold Storage Company has been incorporated with a capital of $100,000 to establish an ice and cold-storage plant in this district. Headquarters will be maintained at San Francisco, Cal.

Charles S. Gilbert, Los Angeles, Cal., is at the head of a company which plans for the erection of a large rock-crushing plant at Temescal Wash, near Corona, Cal. The plant will be fully equipped with modern machinery.

The San Joaquin Light and Power Company, Fresno, Cal., will build a new machine shop and garage for the care and repair of its automobiles on O street. The plant will be fully equipped. A. G. Wishon is manager.

Power-plant equipment will be installed in the new 10-story office building to be erected by Holtz Brothers, Portland, Ore., on Fifth and Washington streets. Doyle, Patterson & Beach, architects, Portland, are preparing plans.

The Smith, Kerry & Chase Engineering Company, Portland, Ore., has broken ground for the erection of a large electric power plant at Crane Falls, near Mountainhome, Ida. The plant will have a capacity of 14,000 horsepower.

The Lewiston (Ida.) Candy and Cracker Company has acquired additional property, and will establish a plant for the manufacture of its products. A full equipment of necessary machinery for this work will be installed.

The Dinuba (Cal.) Board of Trade is interested in a plan to establish a modern creamery plant in this district. An ice-manufacturing plant will be erected in connection. The company will be coöperative and composed of citizens.

The Brown & Doane Lumber Company, Red Bluff, Cal., has been incorporated with a capital of $50,000. The company plans for the operation of a planing mill and box factory plant. A. L. Brown and Scott Doane are interested.

The Madison River Power Company, Ruby, Mont., is planning to install a complete power and lighting system at Virginia City, Mont. A transformer station is to be erected at Laurin. Kerr & Buck are at the head of this company.

It is announced that the Fuller Engineering Company, Allentown, Penn., will be in charge of the work of the large cement-manufacturing plant planned at Millwood, Wash., by the International Portland Cement Company. The plant is estimated to cost $1,000,000.

The Fisher Milling Company (flour), Seattle, Wash., plans to increase the capacity of its large milling plant at West Waterway. New machinery will be installed. The company has increased its capital from $400,000 to $1,000,000.

The Sierra Buttes Mines Company, near Sierra City, Cal., contemplates the erection of two hydroelectric power plants on Salmon and Sardine lakes, with a total generating capacity of 20,000 horsepower. E. A. Hayes, San Jose, Cal., is head of this company.

The Salt Lake railroad is having plans prepared for modern fruit-packing plants on Fourth street and on First street, Riverside, Cal., and for an addition to its packing plant in Pasadena, Cal. E. M. Jessup, division engineer, Los Angeles, is in charge of this work.

The city of Eugene, Ore., plans for the installation of a complete power and lighting distributing system throughout the city. A tungsten street-lighting system to cost $25,000 will be installed in the business district and main streets. The city council is interested in this work.

Power-plant equipment will be installed in the new 12-story hotel building to be erected at Rainier National Park, Wash., by the Chicago, Milwaukee & Puget Sound Railway Company, Chicago. About $500,000 will be expended. Architects, Bebb & Mendel, Seattle, Wash., are preparing plans.

The Board of Public Works, Los Angeles, Cal., is in the market for 900,000 pounds of steel for five miles of siphons to be constructed on the line of the Los Angeles Aqueduct. Bids will be received up to November 17. W. M. Ormsby, storekeeper for the aqueduct department, has specifications for the work.

The United States Refining Company of California is planning for the erection of a large oil-refining plant near Los Angeles, Cal. The plant will be fully equipped and is estimated to cost $750,000. This company is a subsidiary of the United States Refining Company, Boulder, Colo. T. L. Drake is manager.

In connection with its proposed pipe line from Lost Hills district to Port Harford, Cal., the Universal Oil Company, Lost Hills, near Bakersfield, Cal., the Universal Oil Company, Los Hills, Bakersfield, Cal., will install several large pumping plants. The entire cost of this work is estimated at $1,000,000.

The American Power and Light Company, Portland, Ore., has acquired the Hanford (Wash.) Irrigation and Power Company. The new owners contemplate extensive improvements in the power system and will increase the capacity of the power plant at Priest Rapids. Guy W. Talbot is president of this company.

A complete electric-light and power plant, heating plant, refrigerating and vacuum cleaning plant will be installed in the New Rosslyn hotel, to be erected by Hart Brothers, on Fifth street, Los Angeles, Cal. The structure is estimated to cost $1,000,000. Parkinson & Bergstrom, architects, Los Angeles, are preparing plans.

The State Board of Control, Olympia, Wash., is advertising for bids up to November 6, for the erection of a power plant at the Northern Hospital for Insane, Sedro-Woolley, Wash. Saunders & Lawton, architects, Seattle, Wash., have prepared plans. Boilers, engines and generating machinery will be installed.

The lumber plant of the Booth-Kelly Lumber Company, Springfield, Ore., recently destroyed by fire, with a loss of $250,000, will be rebuilt in the immediate future. The new plant will be fully equipped with modern woodworking machinery, including band saws, planers, edgers, etc. The capacity will be 175,000 feet per day.

C. L. Merrill, Los Angeles, Cal., is at the head of a company which plans for the erection of a large oil-refining plant at Avila, Cal. The company will also build an asphaltum reduction plant and refinery. Modern machinery will be installed throughout. The company will be known as the Port Harford Asphalt Company.

The Kuhn Corporation, Pittsburg, Penn., has acquired the Swan Falls Power Company, near Boise, Ida. A large hydroelectric power plant is planned on the Snake river to supply electric light and power throughout this district. A light and power franchise will be applied for at Boise. J. S. and W. S. Kuhn are at the head of this corporation.

CANADA

Saskatoon, Sask., will equip a 4,000,000-gallon filtration plant.

Innisfail, Alta., will install a complete new electric-lighting system.

Portage La Prairie, Manitoba, will equip a municipal electric plant.

The Boeckh Brothers will enlarge their brush plant at Toronto.

The Electrical Power Company, of Lindsay, Ont., will extend its plant.

The London Barrel Company will build a large addition to its factory.

The City Cold Storage Company will equip a new $100,000 plant at Regina.

The Watson Gun Sight Company, of Niagara Falls, will build a new factory.

The E. H. Heap Company will equip a woodworking factory at Ruskin, B. C.

The United Electric Light and Power Company will equip a new plant in Winnipeg.

The Toronto Electrotype and Stereotype Company, of Toronto, will buy additional equipment.

The Delhi Canning Company, of Delhi, Ont., will double its plant and install the latest equipment.

Rockwood & Co., of New York, chocolate manufacturers, will erect a six-story factory in Toronto.

The Western Gas and Fuel Company, of Brooks, Alta., has applied for a franchise to install a plant.

The Eel River Heat, Light and Power Company will equip a new $300,000 plant at Fredericton, N. B.

George Colgrove, of Calgary, will buy machinery for developing a large new stone quarry near there.

H. H. Harrison, of Halifax, N. S., will equip a $50,000 plant at East Lake Ainslie, N. S., for crushing barytes.

The John Tod Hunter Company, Fernie, B. C., will establish a brick and tile manufacturing plant near Fernie.

The Canadian Dairy Supply Company will equip a new plant for manufacturing dairy supplies at St. Johns, Que.

St. Marys, Ont., will extend its hydro-electric system and has passed a bylaw to buy $15,000 worth of additional equipment.

The Holeproof Hosiery Company, of London, Ont., is remodeling its present factory and a large quantity of new machinery will be installed.

Lever Brothers, of Toronto, will erect a $1,000,000 soap-manufacturing plant at Vancouver and a large quantity of the latest machinery will be purchased.

The Hudson Bay Company will build a $1,500,000 department store at Calgary and will call for tenders shortly for boilers, engine, electrical equipment, elevators, etc.

The St. Lambert-Waterloo section of the Central Vermont railway will be transformed from a steam to an electric road and electric locomotives and equipment will be purchased at once.

The Battle Creek Corn Flakes Company, London, Ont., will have plans prepared shortly for a new factory which will double the size of the present plant. New machinery will be installed.

The Lantz Marble Company, of Buffalo, N. Y., has secured three acres of land at Bridgeburg, Ont., for a new factory to be erected at a cost of $5000. Machinery costing $35,000 is to be installed.

A deal has been closed for about 12 acres of water front on Burrard inlet, Vancouver, B. C., on which will be erected a soap factory for Lever Brothers, Toronto and Montreal, which, with machinery, will cost about $1,000,000.

MINING

The Oro Fino mine, La Porte district, Cal., will install a new 5-stamp mill.

The Oaks Mining Company, Mogollon, N. M., plans for the erection of a large milling plant.

The Leebrick mine, near Idaho Springs, Colo., will double the capacity of its milling plant.

The Bluebell mine, near Glencoe, Cal., plans for the erection of a concentrating and cyanide plant.

Mr. Molesworth, operating on South Myrtle creek, near Myrtle Creek, Ore., will install a stamp mill.

The Italian Mountain Mining Company, Crested Butte, Colo., plans for the erection of a milling plant.

W. S. Clark, Butte, Mont., operating zinc properties, plans for the erection of a large zinc smelting plant.

The Tonopah Mines and Exploration Company, Aurora, Nev., plans for the erection of a 100-ton milling plant.

The Conradi mine, near Rail Road Flat, Calaveras county, Cal., will increase the capacity of its stamp mill.

The Azusa Mining Company, near Glendora, Cal., contemplates the erection of a 10-stamp mill. A. Stanley is superintendent.

The Wallace Development Company, Osburn, Ida., operating the Nellie mine, plans for the erection of a concentrating plant.

The Wilber Mining Company, near Gilmore, Ida., will build a 10-ton milling plant. M. M. Johnson, engineer, is in charge of this work.

The Rye Patch Mining and Leasing Company, Rye Patch, Nev., plans for the erection of a mill and concentrating plant. C. B. Conlin is manager.

The American-Dutch Mining Company, Union Pass, Kingman district, Ariz., plans to install new operating machinery. E. W. Hageman is head of this company.

The Keller-Indiana Smelting Works, Keller, Wash., has been acquired by H. J. Lefevre, Spokane, Wash. Extensive improvements will be made in the plant and new equipment installed.

The Four Ace Mining Company, operating the Santa Ana mine, Stringer district, near Randsburg, Cal., plans to install new operating machinery, including machine drills and hoisting machinery.

The Goldfield (Nev.) Deep Mines Company, recently organized, is having plans prepared for a large reduction plant. New operating machinery will also be purchased. J. R. Clark is head of this company.

The Greenwater (Cal.) Copper Mining and Smelting Company has acquired the O. K. mine, near Dale, Cal. The company plans to install new operating machinery and make extensive improvements. About $190,000 will be expended.

The Granby (B. C.) Mining and Smelting Company has acquired a smelting plant at Hedley, Ketchikan district, Alaska. The company will remodel the plant and install new equipment. A power plant will be erected and the smelting works operated by electric power.

FORTHCOMING MEETINGS

National Society for the Promotion of Industrial Education; fifth annual meeting, Cincinnati, Ohio, November 2-4, 1911. R. T. Davis, secretary, 18 West Forty-fourth street, New York city.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Test indicators. H. A. Lowe, Cleveland, O.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, AMER. MACHINIST.

Wanted work in light stamped sheet-metal specialties. Bernardin Bottle Cap Company, Evansville, Ind.

Wanted—Screw machine work; send blueprints or samples for quotations. Remington Mfg. Co., Fitchburg, Mass.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Well established concern would consider manufacturing a small patented machine on royalty. Box 1372, New Haven, Conn.

Autogenous welding of broken cylinders and crank cases is most expertly done by Waterbury Welding Works, Waterbury, Conn.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Special machinery designed and built to order; tools, jigs, fixtures, sheet metal tools and stampings. Frank J. Dyett Co., Ilion, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Wanted—To buy a small uptodate foundry and machine shop with an esablished business, proferably in West or South. Box 511, AMERICAN MACHINIST.

Hungary—A Budapest firm of high standing offers opportunities for increase of trade to a few first class American tool houses; references exchanged. Reply Box 512, AM. MA.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Die and press tools from the simplest to most intricate designed and constructed by experts; will make dies to produce parts and articles of sheet metal at minimum cost; will manufacture parts from the tools if this is desired. Address Die and Press Department, The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CALIFORNIA

Wanted—On the Pacific coast, first-class toolmakers for experimental work; special tools, dies, etc., for small work in the typewriter class. Box 522, AMER. MACHINIST.

MASSACHUSETTS

Wanted—Experienced Gisholt lathe and vertical boring mill operators; must be first-class mechanics with good references. Box 460, AMERICAN MACHINIST.

Wanted—Traveling salesman, must have practical experience with modern machine

tools; good reference is required. Box 464, AMERICAN MACHINIST.

MICHIGAN

We are frequently needing good operators for turrets and gear cutters, principally Jones & Lamson and Gleason, and invite applications. Frost Gear & Machine Co., Jackson, Mich.

Wanted—Salesman to sell the best cutting oil on the market; must be high-grade man with good connections; state experience and territory; splendid side line; good commission. Box 526, AMERICAN MACHINIST.

MINNESOTA

Wanted—Experienced gasolene engine draftsman; good salary and steady employment. Apply to the Campbell Motor Co., Wayzata, Minn.

MISSOURI

Wanted—Superintendent who can invest $2000 to $3000; five-year contract. Suite 616, Commerce building, Kansas City, Mo.

NEW JERSEY

Wanted—Foreman machine shop doing general work; Newark, N. J.; 30 men, must be first class; state salary and experience. Box 534, AMERICAN MACHINIST.

NEW YORK

Wanted—Machinist on machine repairs, who is experienced in oxyacetylene welding. Otis Elevator Company, Yonkers, N. Y.

Wanted—Experienced Gisholt lathe and vertical boring mill operators; must be first-class mechanics with good reference. Box 461, AMERICAN MACHINIST.

Wanted—Traveling salesman, must have practical experience with modern machine tools; good reference is required. Box 463, AMERICAN MACHINIST.

Wanted—Metal pattern maker, experienced on valves and fittings preferred. In replying state age, married or single and wages expected. Box 492, AMERICAN MACHINIST.

Wanted—Tool steel salesmen for all States to sell a leading brand of high-speed and carbon steels; write, giving particulars, age, salary expected, experience, territory covered, to Box 259, AMERICAN MACHINIST.

Wanted—Chief draftsman acquainted with crane and hoist construction; one who can give positive evidence of ability, can secure permanent and satisfactory position. Address Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Opening for young man in cost office of large hardware factory in central New York; technical training and some accounting experience preferred; salary not less than $650 to start; an unusual opportunity in a modern plant. Box 494, AMERICAN MACHINIST.

Tool Designers—Experts on punches and dies; only topnotchers, capable of earning big money need apply; a first-class proposition for the right kind of man; work in New York City. Write, stating age, nationality, experience and salary expected. Box 514, AM. MA.

Draftsmen—Thoroughly familiar with machine shop practice on small interchangeable parts of electrical apparatus; position only for first-class men capable of earning top market price; no others need apply. Write, stating age, nationality, experience and salary expected. Box 515, AMERICAN MACHINIST.

OHIO

A first-class man for inspector of parts and special tools in a shop manufacturing machine tools; state age, past experience, references and wages expected. Box 491, AM. M.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted—Experienced Gisholt lathe and vertical boring mill operators; must be first-class mechanics with good references. Box 462, AMERICAN MACHINIST.

Wanted—Draftsman familiar with designing milling machines, gear cutters and similar machinery; write fully, giving age and experience and salary expected. Box 477, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

TENNESSEE

Wanted—A first-class diemaker for small and medium sized dies, on novelty work; state age, experience and salary wanted. Southern Stamping & Mfg. Co., Nashville, Tenn.

Wanted—Three or four machinists familiar with repair work in jobbing shop, $3 per day; steady work; only those familiar with working in jobbing and repair shop. Atlas Machine Co., Nashville, Tenn.

WISCONSIN

Wanted—Draftsman familiar with designing centrifugal pumps and other hydraulic machinery; location, Middle West. Box 419, AMERICAN MACHINIST.

FOREIGN

Grinding wheels, etc.; old established firm in England requires man to start and manage vitrified plant; none but thoroughly competent men need apply; applications stating full experience and terms treated in strictest confidence. Box 524, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Salesman or representative of machinery or mechanical goods in Canada by person with 14 years' mechanical experience. Box 472, AMERICAN MACHINIST.

CONNECTICUT

Wanted—By an American man of executive and mechanical ability, an opportunity to locate with a party engaged in the manufacture of high-grade machine work; could invest a small amount of capital. "C. P. W.," AM. M.

ILLINOIS

Mechanical draftsman and designer, technical graduate, 11 years' experience in United States of America and Germany; can furnish very best of references. Box 510, AM. MACH.

Uptodate mechanical engineer and expert is open for engagement after February next; 25 years' experience in designing and superintending manufacture of small high-class machinery, tools and fixtures. Box 495, AMERICAN MACHINIST.

Wanted—Position as superintendent or assistant superintendent of factory; practical machinist with engineering education, wide experience in electrical, engine and general machinery manufacturing; good organizer and executive; familiar with uptodate practice and methods; at present employed; age 40; married; 12 years' successful record in previous positions; Middle West preferred. Box 478, AMERICAN MACHINIST.

IOWA

Patternmaker-draftsman, first class, desires change; general experience; capable estimator and organizer; technical education; good record; sober; East or South. Box 508, AMERICAN MACHINIST.

MASSACHUSETTS

Position as superintendent of machine shops or master mechanic of factory; first-class references; all-around man. Box 469, AM. MA.

November 15, open for engagement; an American having 25 years' practical and executive experience, from the finest instruments to medium size machine tool work. Box 519, AMERICAN MACHINIST.

General foreman of manufacturing, now employed, wishes change, either as superintendent, assistant superintendent or chief tool designer; expert on the design and operation of all automatic machinery, including all automatic screw machines; technical graduate, "Designer," Box 518, AMERICAN MACHINIST.

MICHIGAN

Heat Treating—Expert in metallurgy of steel treating, now visiting large plants, tired of traveling, wishes position in permanent location. Box 525, AMERICAN MACHINIST.

NEW JERSEY

Mechanical engineer, graduate, 30, with eleven years' experience as erector, designer, estimator and assistant superintendent, in the line of steam power plants and machines, hoisting, conveying and general machinery, also structural work, best references, desires responsible position. Box 528, AMER. MACH.

NEW YORK

Mechanical draftsman wishes position. Box 480, AMERICAN MACHINIST.

Superintendent would consider a change. Box 482, AMERICAN MACHINIST.

Experienced tool and machine designer wants position near New York. Box 483, AMERICAN MACHINIST.

As superintendent or manager with large concern, by man who has and is making good in this capacity. Box 504, AMER. MACH.

Mechanical engineer, age 32, with excellent experience and record, wishes position as mill superintendent or business manager. Box 506, AMERICAN MACHINIST.

Uptodate foreman desires change; wide experience on tools, jigs and general manufacture; good executive; first-class references. Box 532, AMERICAN MACHINIST.

Toolmaker, general machinist, experienced in aëroplanes, motors and special machinery, with inventive and executive ability; go anywhere. Box 527, AMERICAN MACHINIST.

Draftsman, experienced designer, special and automatic machines; first-class record for speed and originality; can take charge of drafting experimenting, etc. Box 531, AM. M.

Production man, all-around mechanic, familiar with lathe, grinders, milling and automatic; able to instruct operators and increase results; at present employed. Box 533, AMERICAN MACHINIST.

Position as expert assistant to general manager, desires high-grade mechanical engineer, where ability and intimate knowledge of manufacturing and general business conditions can be utilized. Box 497, AM. MACH.

Draftsman, young man, expert practical designer for automatic machinery and tools; inventive ability; capable of prosecuting patents, wishes responsible and executive position. Box 509, AMERICAN MACHINIST.

You can engage me as chief draftsman, superintendent or manager for $3500 per year; thorough knowledge of machine designing, pattern making, foundry and machine shop practice; also cost accounting; good executive. Box 523, AMERICAN MACHINIST.

Mechanical-electrical engineering graduate, 15 years' shop experience various lines, designer, engineer, superintendent; will invest $3000 with small going factory, vicinity New York City, taking responsible position; can influence trade. Box 517, AMER. MACH.

Foreman seeking engagement, tool, die, jig or experimental work, automatic screw machines, thoroughly experienced in the management of help and have best of references; seeking position where a man of mechanical ideas is required. Box 520, AMER. MACH.

Mechanical or consulting engineer, good education, broad practical and theoretical experience, good executive, organizer and systematizer, desires executive or confidential position; would accept temporarily position as chief draftsman or designer; willing to travel. Box 521, AMERICAN MACHINIST.

OHIO

Designer of motor trucks; will guarantee to obtain maximum simplicity, durability and silence of operation. Box 501, AMER. MACH.

PENNSYLVANIA

Superintendent, good organizer, capable executive, aggressive, uptodate manufacturer, desires change. Box 431, AMER. MACHINIST.

Mechanical superintendent, with good references, solicits correspondence from uptodate firms in need of a live man. Box 530, AM. M.

Draftsman, tool designer and machinist, experienced on original design and shop management, desires position. Box 507, AM. MA.

Works manager or superintendent, experienced on typewriters, adding machines, cash registers, etc., uptodate on rapid production, at present employed as foreman, desires change; age 36; married. Box 529, AM. MA.

Young man, age 22, toolmaker, technical graduate, employed, desires to make change where by hard, conscientious work, he can advance himself to a responsible position with the firm; can furnish A-1 reference as to character and ability. Box 516, AM. MACH.

Wanted—A position as manager or salesman by young man with technical education; has held both of above positions in automatic machine tool manufacturing concern; desires change owing to business conditions; position in or near Philadelphia preferred. Box 488, AMERICAN MACHINIST.

FOR SALE

For Sale—One of the best drill chucks on the market; this includes patents, tools, good will and everything that goes with the business; a first-class opportunity for some concern that wants to take on more business; must be sold quick; a bargain to the right party. Address Box 836, Watkins, N. Y.

For Sale—Old established field mower business, situated in New England, consisting of patterns, some equipment material in process and good will; great opportunity for a small machine shop to purchase a going business; present manufacturers confining themselves to other lines. Box 471, AMER. MACHINIST.

Talks With Our Readers

By The Sales Manager

At the sale of the famous Robert Hoe collection of books in New York, some time ago, the highest price ever paid for a book was brought.

Henry E. Huntington paid $50,000 for the Gutenberg Bible!

The value of this book is not alone in its beauty, nor in its rarity—for there are thirty-four copies in existence.

It is unique and valuable because it is the first book known to have been printed from movable types.

It was the origin of the modern style of typography.

Way back in 1450 Gutenberg found the way to make printing practical, and from his idea came the evolution of the printing and publishing arts which make it possible for you, today, to surround yourselves with all the books, papers, magazines, etc., that you desire or need.

What Gutenberg did was to see the need of doing something in a newer, better way. He wasn't content with the old methods, so he applied his brain and ingenuity to the task and evolved and adopted a new method.

He was one of the men in history who pushed Progress along—not one of the many who wait for Progress to force them into action.

And in his achievement lies a lesson for all of us.

In every shop there are conditions that can be improved—not necessarily things that have never been done before—but things that we have never done before.

If Gutenberg were a modern engineer he would see these things and he wouldn't rest until he had improved them.

He would be a reader of the advertisements because in them the newer and better things are described and illustrated—and he would never be found behind the times for lack of understanding the value of the modern institution, advertising.

The man who paid $50,000 for the Gutenberg Bible bought it because it is a curiosity—he will probably never read it. He will get his value from it in other ways.

Thanks to the old German printer of the 15th century, you can buy your technical paper today for four dollars a year—

But, you can't get your value out of it unless you read it—read it carefully, systematically and thoroughly.

Gutenberg gave printing the start that enables modern manufacturers to talk to you by means of the printed word.

The story of all the newer and better things for the shop comes to you in type each week.

But even Gutenberg couldn't make type speak—you must read it!

* * *

Only reliable products can be continuously advertised.

A Copper Country Machine Shop

Western Correspondence

A well equipped shop for building and repairing mining machinery at Calumet, Michigan. One of the most important features is a system for keeping several hundred rock drills in order.

Fixtures for boring cylinders, grinding pistons and making fiber piston rings.

Special taps for various purposes, a large reamer and some bits for boring mine timbers.

The Calumet & Hecla Mining Company employs in its different mines in the copper region of northern Michigan some eight or ten thousand men and utilizes a correspondingly extensive mechanical equipment. It has a modern foundry, forge shop, pattern, and machine shops at Calumet, where rock drills and other mining apparatus are built and where engines, compressors, drills, etc., are kept in repair. Its shops are well equipped with modern tools of various kinds and with special apparatus in the line of jigs and fixtures for such parts as are put through the shop in sufficient quantities to warrant the construction of such tools.

Two views in the main machine shop, which is under the supervision of general foreman, William Phillips, are represented in Figs. 1 and 2, the first showing a portion of two rows of heavy tools with the traveling crane in the background, while Fig. 2 illustrates the opposite end of the shop where machinery for lighter work is installed.

Fig. 3 represents an operation frequently performed in this shop, and consisting of turning and grooving wood blocks which form the periphery of a large sheave for a hoisting cable. These blocks are gotten out in the wood-working shop to the desired thickness, correct inside curvature, and angle at ends, and are secured between the flanges of the iron pulley by bolts passing clear through both flanges and blocks. The pulley is cast with round steel spokes in place. When located on the Sellers boring-mill table it is used for finishing several sets of the wood blocks before removal from the mill.

The table is speeded up and the wood-turning tool in the post rapidly finishes the blocks to a true circle and a second tool is then applied for cutting the groove.

Rock Drill Department

The view in Fig. 4 shows the department where rock drills are fitted up and repaired. There are several convenient stands and racks in this department for holding drills that are being assembled and for storing temporarily such parts as cylinders and pistons.

Generally speaking the drill cylinders as they become worn can be rebored three or four times before they are scrapped and the pistons reground a number of times as well. The standard cylinder bore for the size of drill commonly used here is 3⅛ inches, but in the system adopted for taking care of the hundreds of drills in use in these mines, the actual sizes of piston range from 3.071 to 3.160 inches. As the cylinders increase in diameter with reboring and the pistons decrease under the regrinding process, the new pistons as they are made for this department generally start operations in old cylinders and new cylinders (bored under standard size) are commonly fitted with old pistons which have been reground below their original size. Thus the greatest amount of service is secured from both cylinders and pistons before they are finally thrown aside.

Between the maximum and minimum sizes established for cylinder bores and pistons, that is from 3.071 to 3.160 inch, there is always a large number of pistons which are sorted out by diameters and placed on the two vertical stands seen in the background of Fig. 4. One of these stands carries what are called "small" pistons, that is those under 3.100 inch; the other such as are over 3.100 which are known as "large" pistons.

Fig. 1. Calumet & Hecla Mining Company's Machine Shop

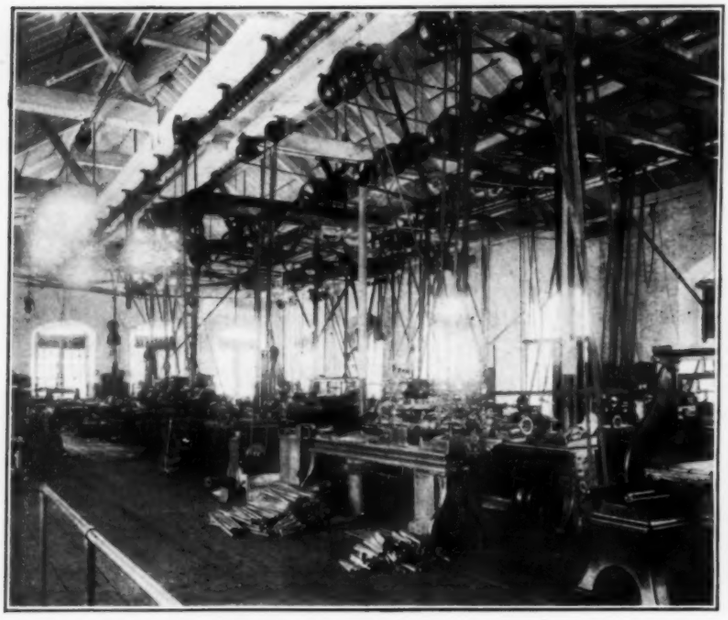


FIG. 2. CALUMET & HECLA MINING COMPANY'S MACHINE SHOP

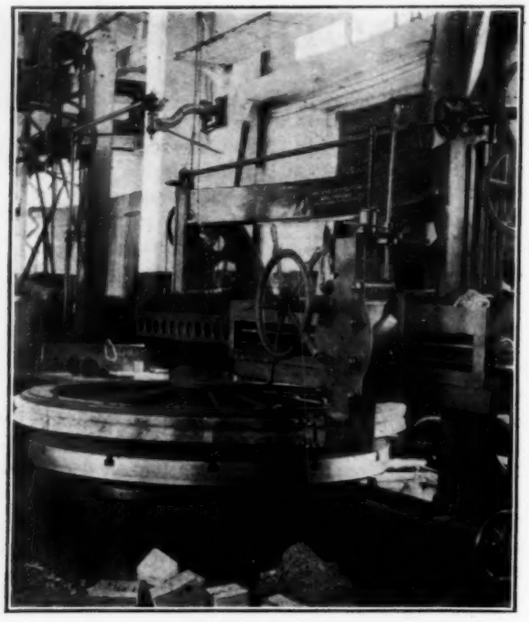


FIG. 3. TURNING AND GROOVING WOOD BLOCKS IN A SHEAVE

The actual diameter as determined by micrometer measurement is chalked on each piston and the workman fitting up a drill selects from the collection of sizes, a piston suitable for fitting to the cylinder he has in hand.

GRINDING PISTONS

The allowance between cylinder bore and piston diameter is about, 0.002 inch. The piston ready for grinding is seen in Fig. 5 in the Brown & Sharpe machine. It consists of the piston proper, *A*, into which the shank *B* of the chuck *C* is secured by means of a taper fit and by a ½-inch pin driven crosswise through piston body and taper chuck end. These parts are shown separately in Fig. 6, which also gives a good idea of the appearance of a rock drill chuck as it comes to the repair shop from the mine.

Referring again to Fig. 5, it will be noticed that the chuck end of the piston is secured in the regular grinder chuck, while the piston body is carried in a cat-head chuck running on the tail center. The cat-head screws enable the piston to be trued up accurately to a test indicator before the operation of grinding is started. The solid drill head *D* through which the chuck body passes in a close running fit, is prevented from rotating with the piston by means of a block pushed under one of the through bolt lugs on the head.

CHUCK AND PISTON ASSEMBLING

A word may be said here about the method of assembling new chucks and pistons. The taper end which is driven into the piston is finished ¼ inch taper per foot and the hole in the piston is reamed accurately to this taper. A square of typewriter paper is wound around the taper rod and with the taper end slipped through the drill head and into the taper

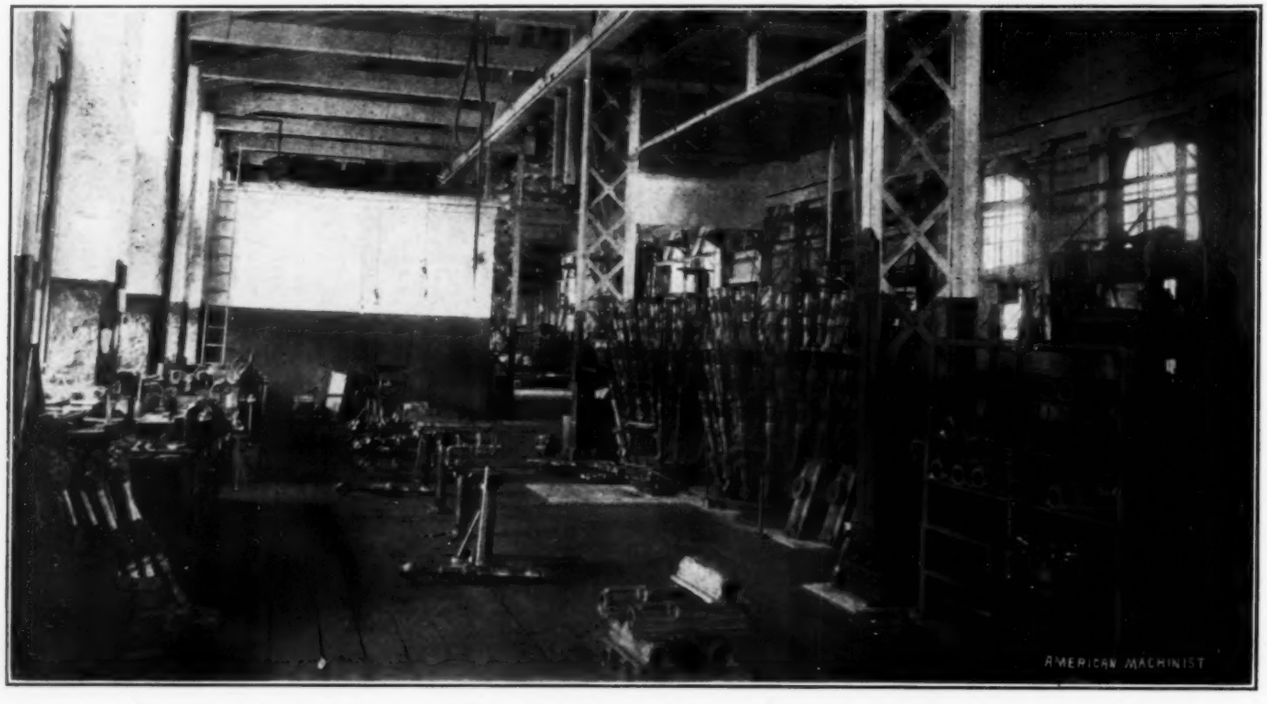


FIG. 4. ROCK-DRILL DEPARTMENT

hole in the piston, the piston is placed on end on a babbitt block and a half dozen good blows struck with a sledge on a piece of stock resting in the chuck mouth. A crosswise hole is then drilled and a ½-inch pin is driven through both parts and filed off smooth and flush with the piston surface.

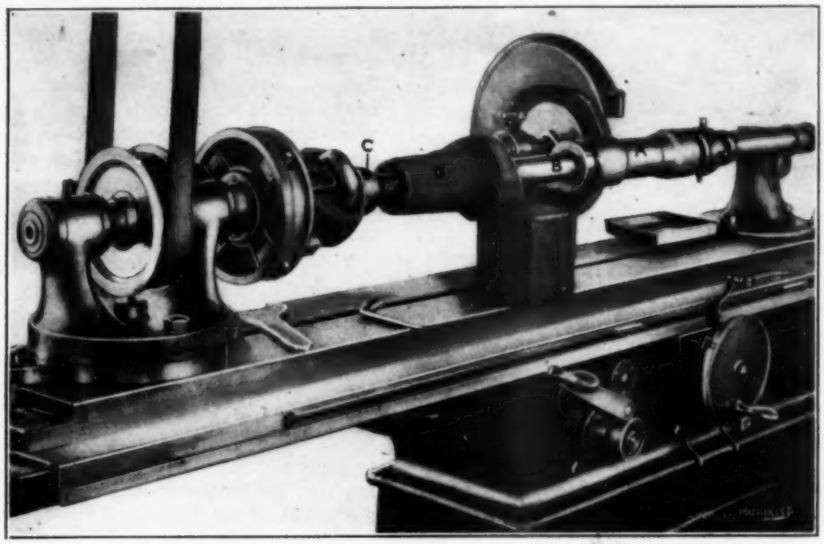


FIG. 5. GRINDING ROCK-DRILL PISTONS

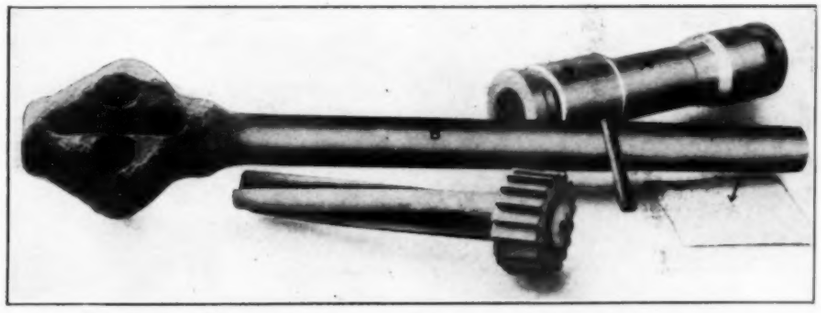


FIG. 6. OLD ROCK-DRILL CHUCK, PISTON AND ROTATION RATCHET

It has been found that with the square of paper applied as described and the parts driven together snugly, the drill will operate for months before shearing off the cross pin, where before the paper was used the pin usually sheared off much earlier in service.

When an old chuck is attached again to an old piston, the paper is wound around the taper end and the chuck driven home until the pin holes in the shank and piston coincide, so that the half-inch pin may be driven into place without the drilling of new holes.

CYLINDER BORING FIXTURE

A fixture for holding rock-drill cylinders for reboring is shown in Fig. 7. The fixture is mounted on the carriage of the lathe and a boring bar is carried between the lathe centers. The cylinder slips into the fixture from the end and is located upon its guides the same as when assembled in the complete rock drill, and the bore is thus kept parallel with the guiding surfaces upon which the cylinder travels when in service.

In boring and counterboring new cylinders, double-end cutters are used, except for the finishing cut where a single-end cutter is applied. A single-end cutter is also used for the reboring of old cylinders, only one cut through the bore being necessary in the majority of cases.

FEED NUT OPERATIONS

Feed nuts are put through the shop in lots of four or five hundred. These are of wrought iron cut off in a turret lathe

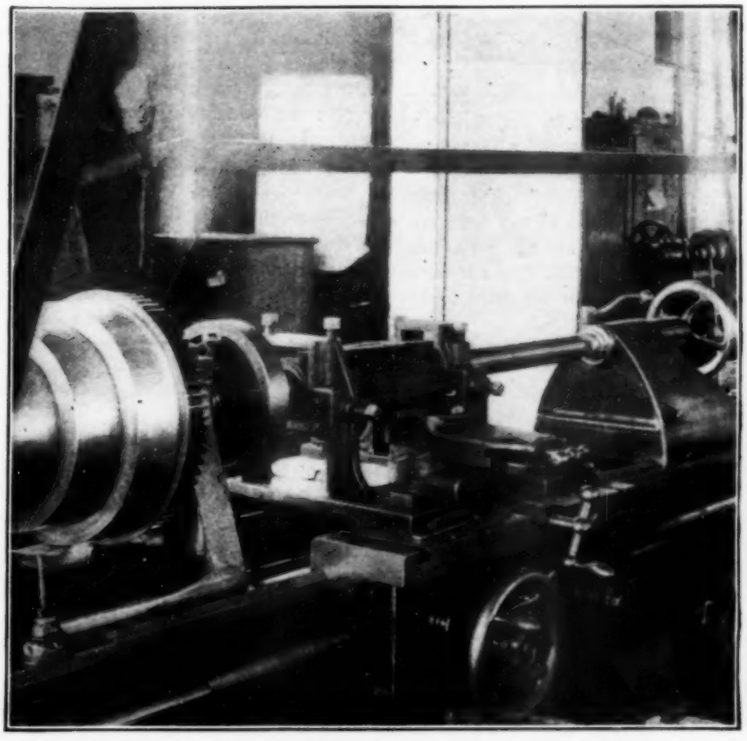


FIG. 7. FIXTURE FOR BORING ROCK-DRILL CYLINDERS

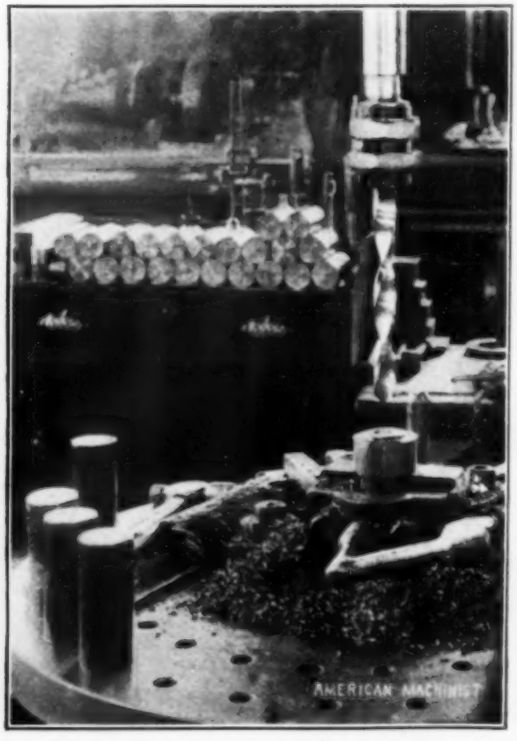


FIG. 8. DRILLING FEED NUTS FOR ROCK DRILLS

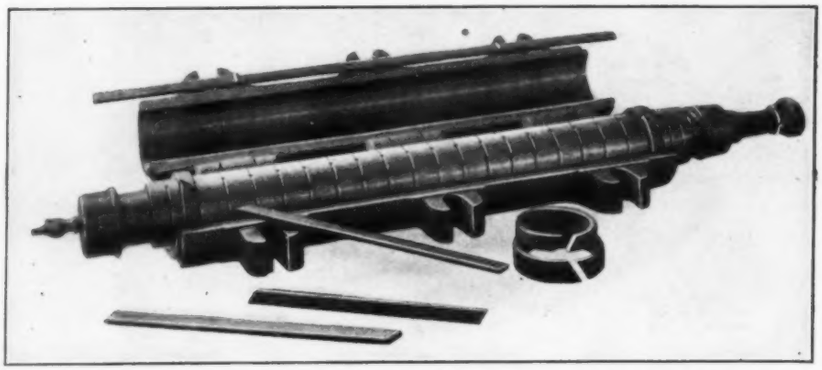


FIG. 9. FIXTURE FOR MAKING FIBER PISTON RINGS FOR ROCK DRILLS

and drilled in a vise with a simple cap jig which slips over the upper end of the blank and guides a Celfor drill. They are tapped with two taps in another machine.

The fiber is first cut from sheet stock in strips of the required width and length, and these are placed in boiling oil for about fifteen minutes. They are then bent roughly on the ends to allow them to curl

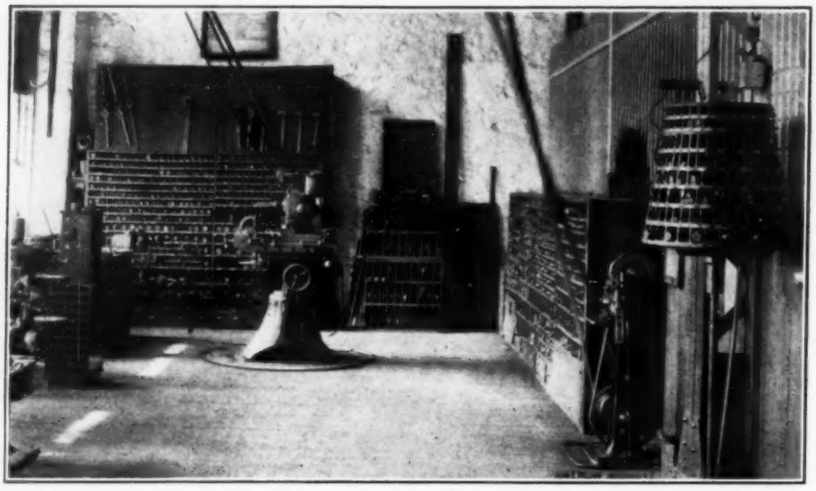


FIG. 10. A CORNER OF THE TOOL ROOM

FIBER PISTON RINGS

An interesting feature of the rock-drill work in this shop is a method of making fiber piston rings as developed by the department foreman, James Mackay, who adopted this type of ring a number of years ago. It has been found that these rings give long and satisfactory service and keep the cylinder bore in excellent condition.

up properly in the fixture and are ready for bending into rings. The fixture for the purpose is illustrated by Fig. 9, which shows several fiber strips and a few completed rings in the foreground.

The fixture is a hinged case long enough to admit 26 rings of the standard 3⅛ size. The strips, by the way, are cut $\frac{1}{16}$ inch longer than the cylinder bore requires in order to allow the ends to be dressed off and the ring joint to be fitted tight. The roughly bent strips are placed on a perforated brass tube, which is adapted to be connected with a steam pipe and the tube with its two dozen and more pieces of fiber is placed in the open fixture. This, when closed, bends the fiber strips to a truly cylindrical form and when the lid is fastened live steam is turned in, the pet cock at the left end of the fixture being left slightly open to allow the steam to leak slowly through the device.

The fiber rings are subjected to this steaming process for an hour and a half and when removed from the fixture are perfectly round and ready for fitting to the piston and cylinders. A regular flat spring is used under the hard fiber ring.

The fixture is shown with a lining which can be removed when it is desired to make a larger size of ring; in this case a larger perforated tube is required for the inside of the ring.

THE TOOL ROOM

A view of one end of the tool room is presented in Fig. 10. This department is well fitted up with machine tools and with appliances for storing and handling small tools for delivery to the shop. One of the revolving tool racks which have been found convenient here is seen at the right-hand side of the room.

A number of interesting tools pointed out by tool-room foreman, G. H. Gill, are shown in Figs. 11 to 14. The first of these engravings illustrates several special taps. The upper two taps are for feed nuts and the bottom one of the two is used as a rougher for removing about half the stock. It is a single-thread tap 2½ threads per inch, 3 flutes, with every third tooth in successive lands cut away to give a free cutting action. The finishing tap at the top of the group is a plain tap, tapering for the greater portion of the length. Both taps are relieved on the thread with an eccentric backing-off device used in the lathe.

The stay-bolt tap in Fig. 11 consists of a threaded rod upon which one, two or

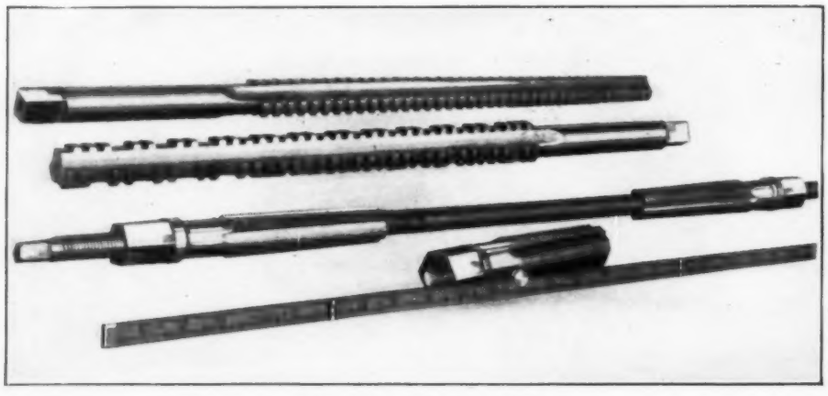


FIG. 11. SPECIAL TAPS

FIG. 12. GEAR-TOOTH CUTTERS

more hollow taps are screwed and spaced as required. The taps are threaded externally and internally in a certain definite relationship so that continuity of lead from one tap to another is positively maintained regardless of the distance between the taps. The threaded rods are made of various lengths to meet conditions and of as large diameters as the sizes of taps will permit.

Gear Tooth Cutters

The three cutters in Fig. 12 are formed shank mills for cutting teeth in large gears. These cutters are used in a special attachment on the boring mill, Fig. 3. When the gear-cutting job is put in this machine the table is arranged for indexing the work and a milling attachment is applied in such a way that the formed end mill can be fed vertically by power across the face of the gear. The cutter spindle in the attachment is driven by a belt from a pulley at the rear.

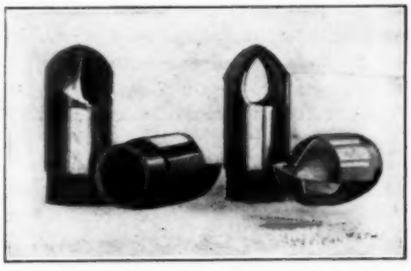


Fig. 14. Wood Bits

The cutter at the left of the group, Fig. 12, is used for finishing wood cogs in mortise gears. The cutters are made up to diameters large enough for teeth of 3 to 4 inches circular pitch.

A Big Solid Reamer

The reamer, Fig. 13, is for compressor crossheads and measures 5¼ inches diameter at the large end by 33 inches in length. It is slightly tapered and is fitted with center plugs screwed in at the ends and left soft so that deflection in the reamer due to hardening can be compensated for by "throwing" the soft centers prior to grinding the outside.

The tools in Fig. 14 are bits for boring holes in mine-shaft timbers to carry sheave idlers. They are very free cutting and can be run through the wood at the rate of 30 inches in half a minute.

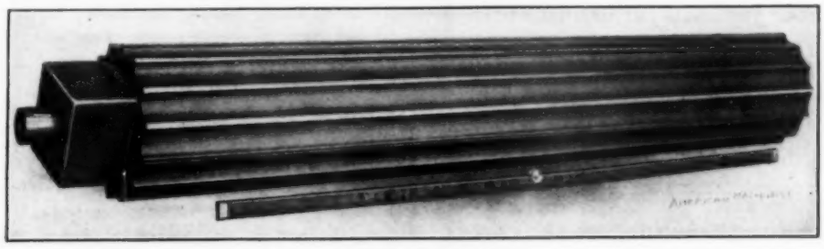


Fig. 13. A Big Reamer

Understudies

By A. B. Christman

Much has been written about organizations, systems and other modern ideas, and much good has been accomplished. But in the final analysis the personnel of the organization, the units of which it is composed, is the prime requisite.

The ideal organization is one in which each and every member contributes his best efforts to the enterprise, and the best system is the one which produces that result. I like to compare the conduct of a factory with that of a professional base-ball club. Some critics declare that the playing strength of a ball club is best gaged by the ability of its "second team," or utility players. If the substitute players cannot properly fill the regular positions in emergencies, the standing of the club suffers in the championship race. So in our organizations, if any one of the units must be replaced, there should be someone ready for the work.

It is all plain to even the most casual observer that we have too many "one-man" shops; shops in which one or perhaps a few men carry around in their heads all the accumulated knowledge of the business, even sometimes to the decimal dimensions of special studs. This is not an exaggeration. I have seen just this state of affairs, not once but often.

As soon as the need of a man is felt, why should recourse be had to the want column? The best man obtainable is necessarily an expensive man, because he must be trained; he must learn the methods, or the line, or both. To "break in" even a plain machine hand costs something. It costs a certain large company $190 each to train experienced assemblers on a certain job. Costs such as these are beyond the powers of the accountant to determine.

In the machine shop of another company making a standard product (automatic weighing machines) and employing 60 hands, there was not one correct tool, reference model or drawing—everybody remembered something. When the foreman left there was confusion. In another instance, when a foreman "gave notice," after more than 14 years' consecutive service, there was consternation, just because he had absolutely all the details in his hand, even to the peculiarities of customers; and though willing, he could not leave this information behind.

In the third instance, a company making a hardware specialty found itself, after making certain advantageous selling connections, 15 months behind orders. Their traveling men on their soliciting rounds were asked why previous orders were not shipped. They had discharged the superintendent and machine-shop foreman, and had hired in their places a superintendent, assistant superintendent, tool-room foreman, machine-shop foreman, systematizer, an extra bookkeeper and an extra clerk; all good men but all new to the line. They are still in business, but were fortunate in having sufficient capital to survive some severe shocks.

In none of these cases were there understudies; there was no one to step into the breach. Understudies might not have been able to do all that was necessary, but they could have helped greatly, and when "new blood" arrived could have helped to amalgamate it.

I hold it to be absolutely imperative that no man, be he owner, manager, minor officer, or even a specialist, should be expected or permitted to carry the entire responsibility for details of any part of an establishment; he should have someone to carry on his work in an emergency. It is true that the more advanced establishments are constantly training men against the time of need, but the greater number seem never to have considered the matter.

The proper selection of an understudy is not an easy task; habits, inclination, temperament, brain power, must all be considered, and these qualities cannot be judged by a superficial examination; the candidate must be studied from many angles—indeed lived with—but when found he is invaluable.

Let us borrow an idea and name from the stage, permit some of our lesser members to learn some of the more important roles, and let us have understudies.

The recent addition to the aëronautical exhibit of the National Museum, at Washington, of the original Wright aëroplane that was publicly flown under Government auspices is a noteworthy one. It will be recalled by our readers that this machine is the one in which the first official public flights held in this country were made at Fort Myer in 1908, and was described in detail at page 473, Volume 31, Part 2. The acquisition of this machine by the National Museum's aëronautical exhibit, already consisting of the steam and gasolene models flown by Langley, Hargrave, Stringfellow and Lillenthal machines, and models of Chanute's gliders, calls for congratulation.

Collecting Data to Compute Costs

By Guido Sacerdote

The forms, indexes and methods used to collect data for determining costs in an Italian machine shop. The various operations and tools are planned for before work is begun and a card issued to the workman giving instructions for the work. The cost and expense of repairing special tools are as carefully determined as the cost of the product.

The installation of a cost system in factories producing large varieties of goods, especially where the production is not confined to a standard and continuous production, but is mixed with special work, experimental work, new articles to be added from time to time to the regular line of manufacture and articles manufactured only intermittently as orders are received, is indeed a much more serious and complicated proposition than is the case in factories manufacturing only a few lines of standard goods.

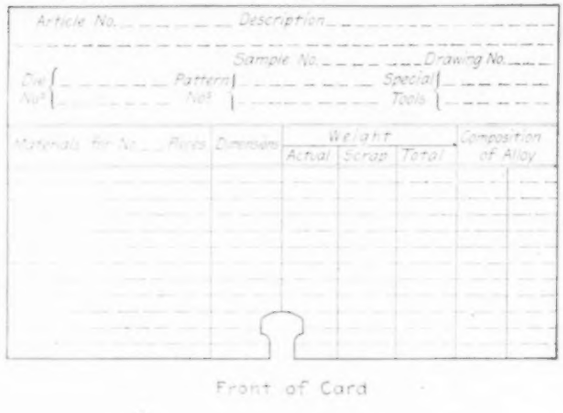
In fact it is just this class of factories that need to collect the most minute and exact data on all the different operations that go to produce a certain article. It is in this class of factories that it is most desirable to install or extend the piece-work system or premium system, or both. It is also often found that it is necessary to keep in force not one, but four different systems of pay at the same time, according to the nature of the work, and whether the rates for piece work or premium are already established, or will be established when sufficient data on a certain article have been collected.

The other two systems of pay usually found are the day rate, which is absolutely necessary for certain classes of work, like drawing, toolmaking, repairing machines, setting machines for work, etc., and the gang system, where a foreman has a contract at a certain piece rate and either pays his own helpers or simply directs their work.

Sometimes a factory has been producing on either or all of these systems, and the aim is to simplify and reduce all rates to piece rate or to premium plan wherever possible. Here again, all the data to be collected must refer to the smallest details of production, because goods manufactured in great variety are usually of moderate dimensions and made in large quantities.

It is the aim of this article to describe a system which was installed in a factory producing metal goods in large quantities and enormous variety, and having 12 different departments, each with a separate foreman. This is the plant of Figli di Raffaele Sacerdote, Turin, Italy.

It was run in the manner mentioned, with four different systems of pay; a system was in existence at the time giving fairly well the cost of the finished articles, but lacking in details regarding the different operations and charges. The aim in installing new system was to obtain as complete data as possible regarding the individual operations, in order to correct and extend the piece-work system combined with a premium plan; to divide the production by departments, in order to set a percentage on it; to interest directly each foreman in his department; to render possible the direct interchange of materials in course of manufacture between the different departments; to avoid unnecessary movement and work in the stock room, and to obtain all the data relative to the movement of materials between the various departments and the stock room.



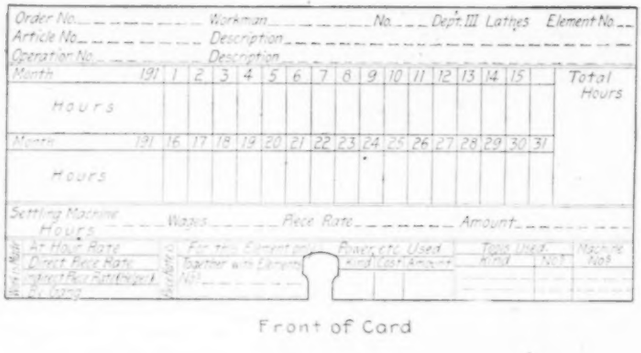


FIG. 1. FORMS FOR FACTORY OFFICE INDEX CARD

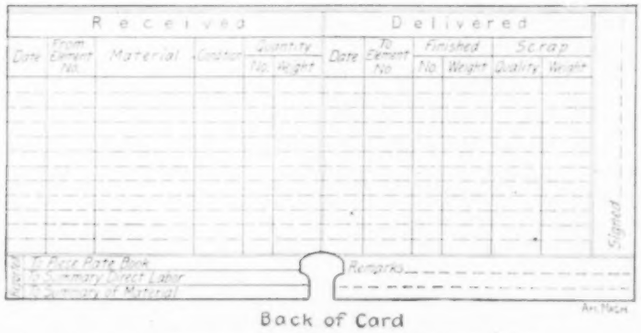


FIG. 2. OPERATION OR "ELEMENT" CARD FORM

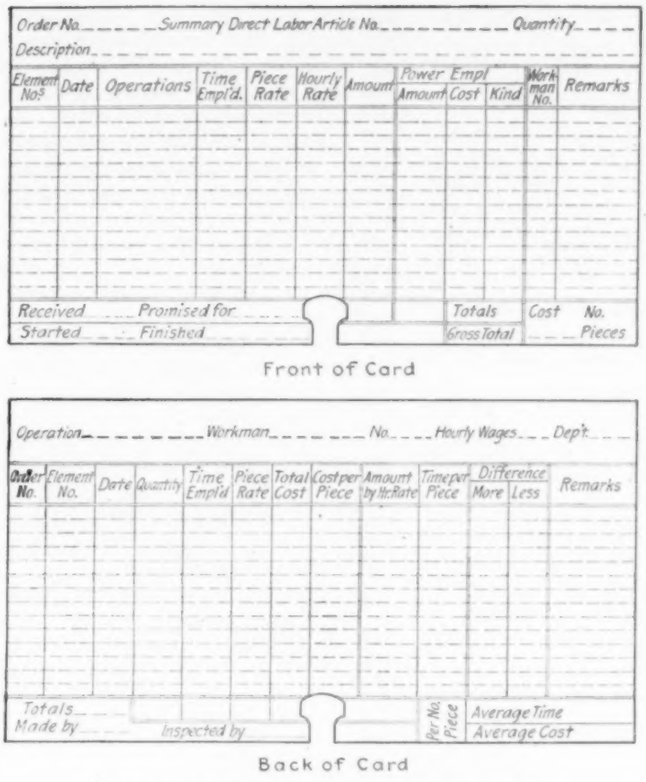

Order No. Summary Direct Labor Article No. Quantity
Description
Element No? Date Operations Time Empl'd. Piece Rate Hourly Rate Amount Power Empl Amount Cost Kind Workman No. Remarks
Received Promised for
Started Finished
Totals
Gross Total
Cost No. Pieces
Front of Card
Operation Workman No. Hourly Wages Dept.
Order No. Element No. Date Quantity Time Empl'd Piece Rate Total Cost Cost per Piece Amount by Hr. Rate Time per Piece Difference More Less Remarks
Totals
Made by Inspected by
Per No. Piece
Average Time
Average Cost
Back of Card

FIG. 3. FORM FOR SUMMARY OF DIRECT LABOR

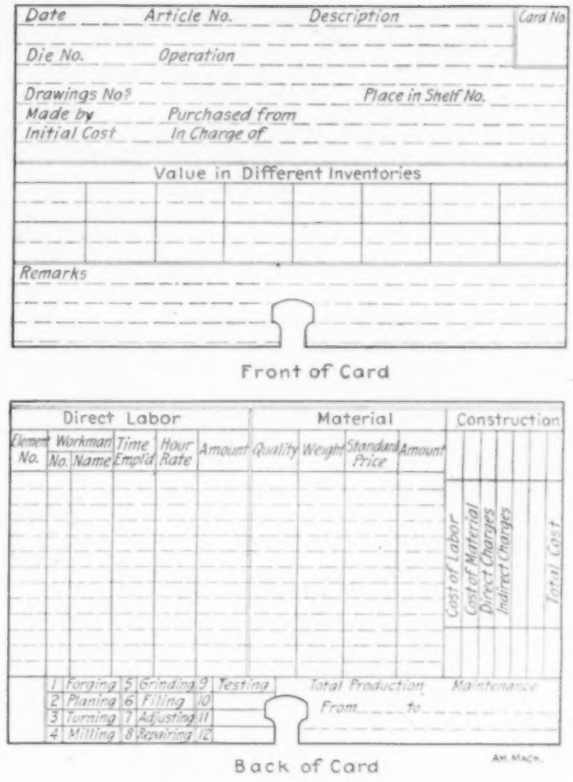

Date Article No. Description Card No
Die No. Operation
Drawings No? Place in Shelf No.
Made by Purchased from
Initial Cost In Charge of
Value in Different Inventories
Remarks
Front of Card
Direct Labor
Element No. Workman No. Name Time Empl'd Hour Rate Amount
Material
Quality Weight Standard Price Amount
Construction
Cost of Labor
Cost of Material
Direct Charges
Indirect Charges
Total Cost
1 Forging 2 Planing 3 Turning 4 Milling 5 Grinding 6 Filing 7 Adjusting 8 Repairing 9 Testing 10 11 12
Total Production From to
Maintenance
Back of Card
Am. Mach.

FIG. 4. RECORD FORM FOR SPECIAL TOOL

In a system of this kind several things are especially important:

IMPORTANT POINTS IN THE SYSTEM

1. That the number of cards to be handled be reduced to a minimum, while the collection of details from them be as complete as possible.

2. That the system be simple and clear; that it require as little writing as possible, especially from the workmen themselves.

3. That it be uniform and elastic enough to adapt itself to be used in all classes of work and all through the factory.

4. That the old order of things be disturbed as little as possible, in order to avoid confusion and delays.

5. That the data obtained for each article and each operation be automatically filed to give an average cost on as large a production as possiblee.

6. That it give a means for comparing the efficiency of the different workmen and tools, and of separately computing piece-work accounts and of comparing the results with day-rate costs.

7. That full data be obtained regarding the cost of production and maintenance of each tool, die, pattern, jig, etc.

8. That data be given for comparing the consumption of supplies, power, etc., on the part of different workmen for ultimately setting a standard of consumption and a premium on savings effected.

In many factories the piece rates, or the standard times for each operation are set by a system of trials made by special men employed for this purpose, or by consultations between the superintendent, foremen and workmen. It is useless to recall the imperfections of these plans, which give in the most cases erroneous figures, unfair either for the workman or for the employer.

In a premium plan, founded on savings effected on a standard time for each operation, it is desirable that the standard time be proportioned to the hourly wages of each workman; in fact, inversely proportional to it so that a workman who has been given a certain wage rate must work by its relative standard time, so

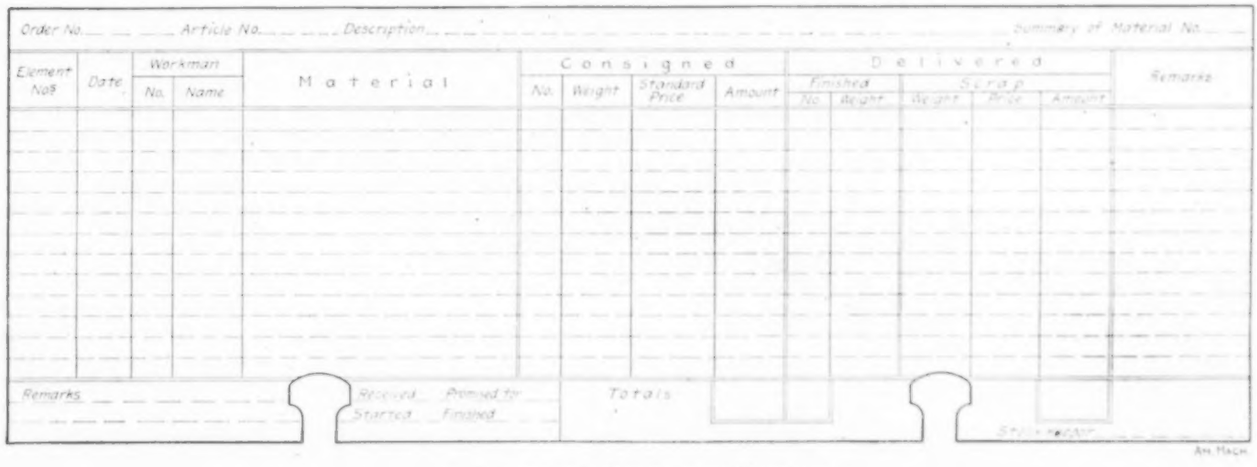


FIG. 5. FORM FOR SUMMARY OF MATERIAL

that he has a chance to earn his wages and a premium besides.

Owing to these considerations, the plan of establishing rates according to results of trials was discarded, and the one was adopted of collecting a great number of data extending over a long period for each operation, so that rates were based on actual work made in the factory under all possible conditions.

The system adopted had, therefore, to meet two prime conditions: 1. That it be able to furnish all the data which have been mentioned in regard to labor, material, supplies, direct and indirect power consumption, etc., in order to deduct from them the standard times and piece rates, and the standards of consumption of supplies and power in each operation. 2. That it be fit for being kept continuously in use, both to be used in connection with work where the different standards and rates have been already set, and in connection with work where the collection of data is to be made, in order to establish the standards.

In fact even the established rates need to be revised from time to time, owing to changes in equipment, materials or wages, and as new articles are constantly produced, it is evident that the collection of new data must constantly be maintained.

The data to be used for the future setting of the standards come from three different sources; one is the estimated time based on a graduation of difficulty, or in other words on the wages of the class of workman which is supposed to perform the operation; another is the data coming from the workmen's time cards; and the third is constituted by a number of observations of the work made personally from time to time by the superintendent, foremen or special employees.

It is my intention to limit myself to the description of the means used for collecting the various data; which are those that must be carefully devised to save a vast amount of clerical work. The ultimate setting of the different standards and rates, and the complete summaries of cost as well as the different forms giving information as to indirect expenses of various kinds, and various card indexes to be used for inventory or correspondence purposes will, therefore, not be considered.

After exhaustive consideration, it was decided to adopt a scheme where all the work was planned ahead before it entered the production stage; not only the work of preparing the tools and studying the various questions arising with the production, but also all the time cards and summaries of cost of labor and material to be used in connection with the manufacture of each item of each order. All the writing that could be done on the cards previous to their distribution, and all the information possible relating to the work were prepared in the factory office upon receipt of each order.

Method of Classification

The first step was the classification of the goods produced, each class being assigned a set of consecutive numbers sufficient for present and future needs. With this arrangement, all the indexes and documents pertaining to articles of a kindred nature could be filed together. Its advantages were most marked for consulting records, for cataloging purposes and for the arrangement of the sample room.

To give an idea of the scheme: To the class "Building Hardware" was assigned the series 1 to 500; "Electrical Supplies" 501 to 1000; "Car and Wagon Accessories" 1001 to 1500, etc. Each article was given an individual number and the different parts of an article were given the same number, followed by an individual letter. For instance, supposing the

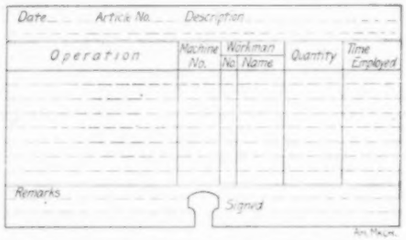


Fig. 6. Form Used by Superintendent and Foremen to Record Personal Observations

distinctive number of "15 Ampere Single Pole Switch" to be No. 609, the different parts were numbered as follows:

15 Amp. Single Pole Switch Lever No. 609-a
" " " " Fulcrum Part No. 609-b
" " " " Contact No. 609-c
" " " " Handle No. 609-d,

When a part entered in the assembling of different articles it was considered as an article of manufacture by itself and given an individual number.

Different card indexes were prepared containing the names and numbers of the articles, alphabetically or numerically ordered according to convenience, and kept constantly in order. One index was for the use of the manager's office, one for the correspondents, one for the stock room, and one for the factory office, which in the present instance was combined with the drawing room.

Factory Office Index Card

For the purposes of this article we are solely interested in the form adopted for the factory office index, which is represented in Fig. 1.

The front of the card besides giving the number and name of the article, gives all the information relative to the sample representing the article—if any—to the drawing, patterns, dies, tools and jigs to be used in its manufacture. The rest of the space is occupied by information relating to materials, scrap, composition of alloys, etc. This is information for the use of the superintendent to prepare the necessary tools and to make requisition of materials upon receipt of the order.

The back of the card has all the necessary information relating to the way in which the article is manufactured. The first two columns give the sequence in which the different operations take place; the next two columns give the department and the machine in which the respective operations are to be performed; the fifth and sixth columns relate to the kind and numbers of the special tools for each operation; the next two columns contain information relative to power, gas for soldering, heat for forging, etc., and their approximate costs. It is understood, however, that these data were limited only to such operations where these were applied and had a direct bearing on the cost of the operations.

The next four columns refer to time—estimated and set—piece rate, and premium to foreman, for each operation and for a given number of articles, which is left in blank to be filled in each case. The last two columns provide space for the quality and for remarks. Part of these informations were to be used only in the future, like those relating to standard times, estimated and set, premium to foremen and to quality. These were consequently left blank for the present time.

Of this form No. 1 two files were prepared, one in alphabetical and one in numerical order. These constituted the basis on which all the system was founded.

Upon receipt of an order it was subdivided into its different items. For those items which had been manufactured before and for which form No. 1 was already to be found, the summaries of labor and material and all the time cards were prepared beforehand in the manner which we will describe later. For the items which were new, the first step was to prepare all the drawings of the special tools necessary for production, giving a number both to the drawings, tools, patterns, etc., and to fill immediately all the forms of No. 1 relating to the article and each of its parts. All the information relating to materials, to the succession of operations, etc., in fact all the information which it was possible to foresee was inserted on the cards, and these entered in the indexes. Then the work for these proceeded in the same manner as for the other items.

The Time Card

Let us now examine the disposition of the time cards and summaries of labor.

The time cards are called and referred to as "Elements," and were provided in different colors; one color for each department. These were designed with the aim of giving the workman all the possible information in regard to special tools

and machines to be used, and to necessitate on the part of the workmen and foremen as little writing as possible; and to be, furthermore, so distinct, as to avoid any possibility of mistakes.

By glancing at the front of the card, and in fact at all the forms, the special study is apparent which has been given to the division of space to collect all the useful information in a clear way and with the necessity of but little writing.

The front of the "Element," Fig. 2, is devoted to information relating to labor and power, while the back is devoted to movements of materials.

Each element refers only to one operation on the same article, belonging to the same order and performed by the same workman. The front contains at the top the numbers of the order and of the article, the number of the operation, the description of the article and of the operation performed. It can, therefore, be filed according to all these data and it is, in fact, filed under the order number before the work is started and during its progress; under the article number when it is necessary to compile the summaries of labor for the article; or others, according to convenience in the course of filling the different card indexes composing the entire cost system.

This feature was found to be very valuable indeed, as the same card was used over and over until all the data had been reported in the proper place.

In the middle section, space is provided for marking the hours for one month. If the work should start on a day different from the first of the month, on the 11th for instance, a line is drawn between the 10th and the 11th; this meaning that the element runs from the 11th of one month to the 10th of the next month.

Then there is space for giving the time employed in setting machines, wages, piece-rates, and amount of work performed under that element.

Besides containing the data relative to the different tools to use, there is space to be filled with data as to power, gas, steam, etc., used, the amount to be computed naturally on the total of the hours employed. Finally it is stated on the card whether the work is performed at piece rate, day rate, or otherwise, whether the rate applies only to the operation to which the card refers, or whether it applies to the same in combination with some other operation given on some other card, which other operation can naturally be performed by the same workman, or by a helper of the same workman.

The back of the card contains data as to materials received and delivered by the workman on that particular job. The material may come from the stock room or from a different department, and may be delivered in the same way. When the work is passed from one department to another it is always preferable that the respective foremen be present.

Summary of Direct Labor and Material

The summary of direct labor, Fig. 3, is compiled from the cards, Fig. 2. The front is devoted to the cost of the several operations going to make a complete article for a single order. The back is devoted only to collecting information on a single operation of the article written on the front, for different orders but for the same workman.

The summary of material is illustrated in Fig. 5, and for convenience in writing has been made in the shape of a folder composed of two cards of the same size as the summary of labor; the two can, therefore, be filed together when convenient. In other respects the form has nothing to distinguish it particularly from other forms in common use, and contains the ordinary data required as to the movements of materials between the stock room and the factory. Each summary is, however, limited, as can be seen, to a certain article belonging to a certain order number.

Let us see now how the system works. Supposing an item of a certain order is an article composed of two parts, three cards, Fig. 1, will be found in the index of the factory office; one for the article complete—the operations for this will probably be assembling, packing, finishing, etc.—and one for each part. Full information is given in each as to the tools, operations, etc., as described. For the purposes of the system, each form, Fig. 1, requires a complete set of elements and summaries of labor and material.

For each form, Fig. 1, therefore, the clerk fills the front of one summary of labor with the numbers of the order and of the article, quantity ordered and description; then he fills the first and third columns with the numbers of the elements and the name of the corresponding operations; these he deduces from the back of form, Fig. 1. The back of the same summary he prepares with the name of one operation, inserting the number of the order in the first space of the first column. Then he prepares in the same manner in the back, as many summaries of labor as there are operations in the back, as many summaries of labor as there are operations in the article referred to and proceeds to prepare the different element cards.

These he fills in the same manner leaving the workman's name in blank, also the wages and inserting the piece-rate if any.

The element cards will be of different colors according to the departments in which the different operations have to be performed; they will evidently be equal in number to the cards of summaries of labor. Furthermore, one summary of material will be prepared with the number of the order and number and name of the article.

All these cards are put in special drawers of "Orders waiting," ready for being distributed when the work is started. The summaries of material, however, are at the disposal of the stock room, as soon as the requisition forms have been filled.

Method of Collecting and Tabulating the Data

After the work is started, the element cards are gradually distributed to the different departments as the work progresses; from the design it can be seen that the same card will last for one month; all the workman or the foreman has to do is to insert the number of hours each day in the space provided for each date.

The element cards do not return to the factory office until they are finished; more are issued from time to time for special operations not anticipated, or for renewals. They are reported on the front of the summary of cost card. All the element cards are, however, returned at the end of each month for registration of piece-rate accounts, to go back to the respective workmen as soon as this be completed. The workmen are in the meantime paid at the day rate, while the premiums, piece-rate differences, etc., are paid at the end of each month.

When a completed element card is returned, the data contained on the front are reported in the summary of labor, and also on the back of the summary devoted to that particular operation; and so on until all the cards have been returned on a certain job.

The back of the card is used especially for controlling the individual movements of material; all the movements from and to the stock room are inserted in the summary of material at the moment they take place.

At the finishing stage of the job we have, therefore, as many summary cards for labor as there are operations. The time cards or elements, however, which we had to handle have been very limited in number, on account of their lasting for such a long time. If weekly reports are issued, they can be compiled also from the element cards, returning them to the workmen at the beginning of the new week.

When a second order for the same article is received the *same* summaries of labor are used; filling the front of the second summary, and filling the second line of each on the back for the respective order and operation.

When as many orders have been completed on a certain article as there are operations the set of summaries of labor is complete. We have in this manner obtained in compact order and with little effort, many summaries of the cost of the

complete article on the front of the cards, and the cost of each operation for each workman so disposed as to give the average cost of that operation distributed over a large production and a considerable number of orders. Keeping these data separate for each workman gives, moreover, means for comparing relative capacities and efficiencies.

It is seen that at the end a very limited number of cards have to be filled and handled, each requiring a moderate amount of work in order to be filled. It can readily be seen how elastic such a system is where all the documents can be filed in different ways, according to convenience.

To give an idea of the simplicity of the system when installed two girls were all that were needed to keep the system running. The factory employed about 160 hands, and manufactured not less than 3000 different articles in the first six months in which the system was working.

Data in Regard to Special Tools

A few words about the manner in which the data relating to special tools, dies, patterns, etc., were collected may not be out of place.

Fig. 4 represents the form used. This is intended to serve as an index card, as a permanent inventory, summary of labor and material for the construction of the tool, and summary of labor and material for its maintenance. The aim in view is, of course, to save as much clerical work as possible, and to handle as few cards as possible.

For each class of tools there was a different color of cards. The front was devoted to such information as more closely pertaining to each particular class of tools.

The figure represents the form used for dies. It can be seen at a glance that on the front are given all the informations relating to the number of the tool, the operation performed, its location, etc., and the value placed on it in the different inventories.

The backs of the cards were alike for all classes of tools. The work in producing and repairing equipment was always done by day rate; besides, the data as to material need not be so particular. The items were summarized on this card, and when the tool was completed a heavy line was drawn underneath the totals. The remainder of the card was then devoted to future expenses for maintenance, the costs relating to production being reported at the right on the top, and those relating to maintenance at the right on the bottom. The total production being known during a given period of time, the expenses for production and maintenance could be properly subdivided and charged in the right proportion when compiling the general summaries of cost.

The data obtained by these cards were supplemented by personal observations of the superintendent and foremen. For collecting these a card of the design shown in Fig. 6 was devised. These cards were given in pad form, and filed under the article number for future reference.

The working of the system described is surprisingly smooth, and answers all the requirements of the details and complications arising in the course of manufacture. It was devised and developed with care, and it is confidently expected that it may receive some useful applications with concerns having the same kind of problems to solve.

Handwheel Turning Fixture and a Broach

By C. K. Tripp

A handwheel-turning fixture that is easily attached to a lathe cross slide is shown in Fig. 1. This fixture, as well as the broach described below, was made in the apprentice department of the General Electric Company, West Lynn, Mass.

The cast-iron bracket of the fixture is bolted to the tool slide, as shown, and in this bracket the yoke *A*, carrying the cutting tool *B*, is turned by the handwheel *C* through the worm and gear on the upper end of the yoke bearing, the handwheel to be turned being carried on a mandrel between the lathe centers.

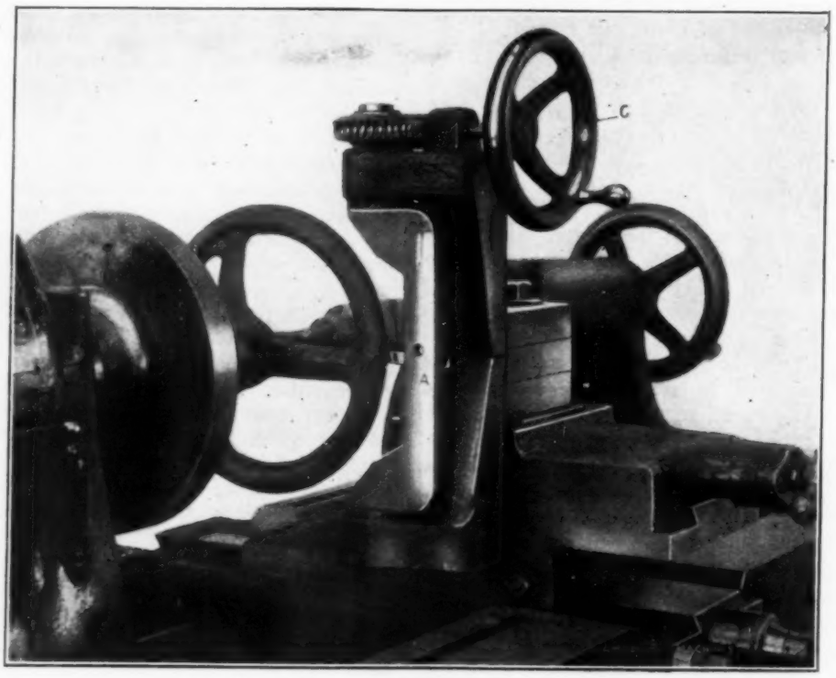


Fig. 1. Handwheel Turning Fixture

Fig. 2 shows a spiral-fluted broach that does excellent work in steel castings, some of the chips being shown in the foreground.

The spirals are cut with one less flute on the right hand than on the left, thus staggering the diamonds so that they will not leave a line in the work. The teeth are backed off slightly, as the halftone shows.

This broach requires very little pressure, and while there was 0.01 inch left in the hole to broach out, it was done in an ordinary arbor press.

Fig. 2. A Spiral Grooved Broach

Black waterproof dressing may be made by mixing together 7 lb. best black paint, ½ lb. powdered litharge, 1 pint oak varnish, ½ pt. boiled linseed oil and ½ pint thick boiled oil. Apply as ordinary paint. It is especially good for railway and wagon coverings, tarpaulins and such articles.

More Locomotive Shop Practice

Editorial Correspondence

A variety of time-saving kinks in use at the shops of the Chicago & Northwestern Railway that help to economize on ordinarily costly repair work.

In the present article some further kinks in use at the shops of the Chicago & Northwestern Railway, Chicago, Ill., are shown.

Fig. 1 shows how the eccentrics are milled on their joining surface on a slab miller. The holding fixture is simply a central plate having the ledge *A* on which the eccentrics rest and the strap *B* which bolts them in place against the center plate. They are easily leveled up, five on each side of the central plate and the two milling cutters shown make short work of the joining surface.

Then they go to the multiple-spindle driller, Fig. 2, where they are held up against the projections carrying the drill bushings by the small jack screws shown. This handles both sides of the eccentric by simply using jacks of different hights and allows the work to be quickly and accurately done.

After the eccentrics are milled and drilled on their joining faces they are bolted together on the mandrel, shown in Fig. 3, to be turned on the outside.

This mandrel has a flange on one end which is bolted to the faceplate, as can be seen, at the correct amount of eccentricity so as to bring the center at the other end in the correct position to be supported by the center in the tailstock. After this, it is a plain job of turning, except for the tongue in the center which fits the groove in the eccentric strap.

In Fig. 4 is seen the fixtures used on a single-spindle vertical driller, both for drilling the oil holes in the eccentric straps or for drilling odd eccentrics in the vise at the left.

The fixture consists of the angle plate *A* and the swiveling portion *B*, which is pivoted on it so that the eccentric strap can be swung into the desired position and have the oil holes come at the right angle to meet the oil cup which is placed on the outside. The index holes in the plate *A* locate the eccentric strap in the desired position and the drill bushing is held in the part of the circle *C*, which fits into the groove made in the strap for the tongue on the eccentric. This locates the hole in the center of this groove which insures efficient lubrication and the angle is easily secured by the index hole shown.

A Welding Job

The use of oxyacetylene welding is growing in railway shops as elsewhere, Fig. 5 showing a repair made on a guide yoke of one of the large engines. This was a steel casting as can be seen, and a crack developed across the upper por-

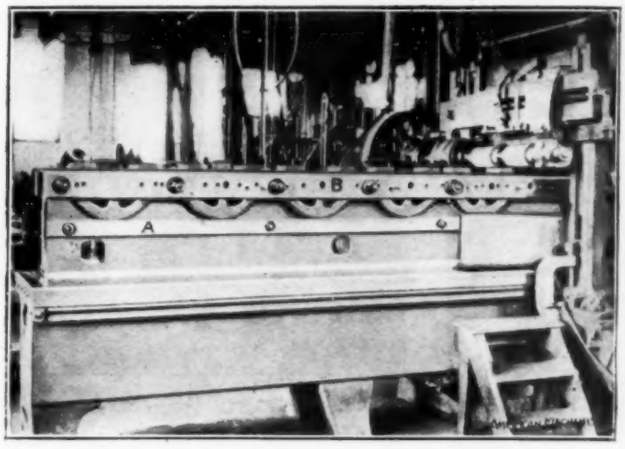


Fig. 1. Milling Joints on Eccentrics

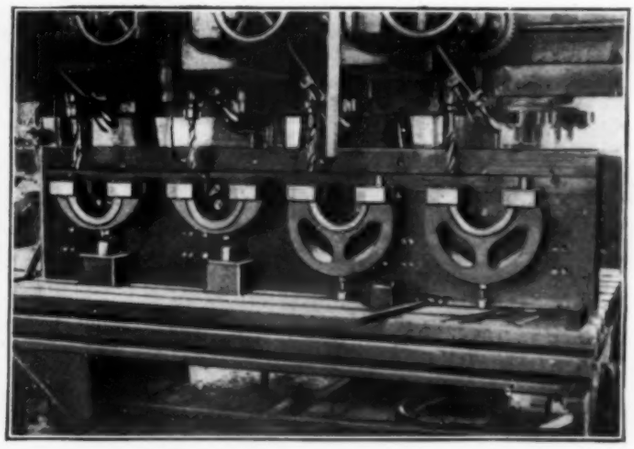


Fig. 2. Drilling Eccentrics for Studs

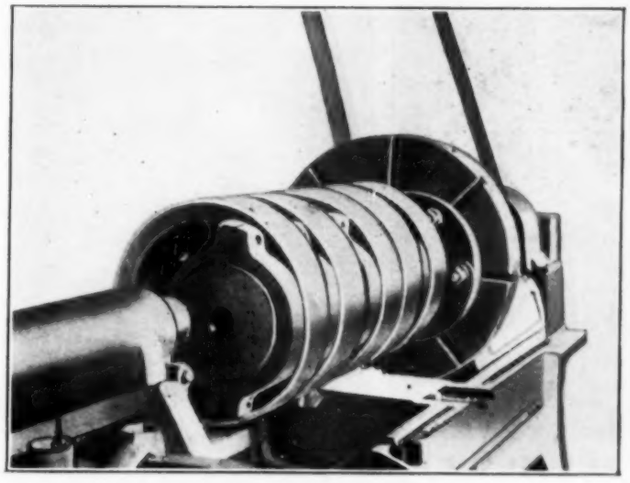


Fig. 3. Turning the Eccentrics

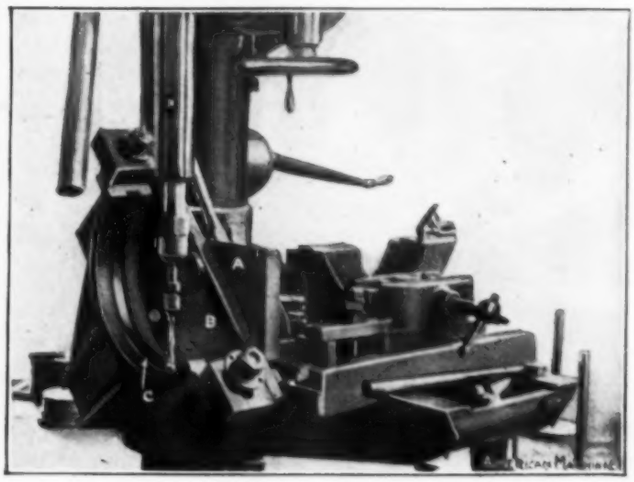


Fig. 4. Drilling Eccentric Strap Oil Holes

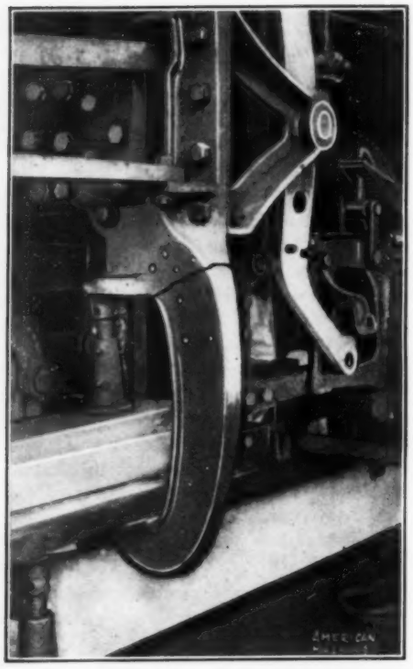


FIG. 5. REPAIRING CRACKED GUIDE YOKE WITH ACETYLENE WELD

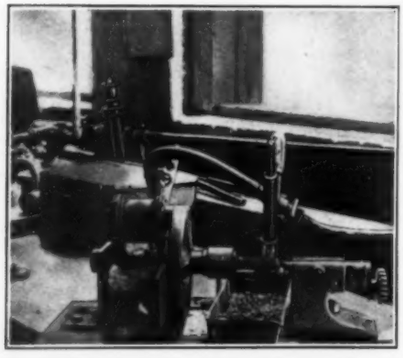


FIG. 6. PORTABLE THREAD-CHASING LATHE

tion along the lines shown. Instead of taking down the yoke it was only necessary to block it in the correct position by the jacks shown, and weld it with the oxyacetylene torch. The time required for this was insignificant as compared with the dismantling of the engine, and it was only necessary to ream out one or two of the bolt holes before putting the upper guide in place and fitting the engine for the road.

REJUVENATING OLD BOLTS

One of the little economies is in using piston head or follower bolts over and over again in making repairs. These are very apt to become bruised either in removal or from being slightly stretched in service, so that it is necessary to true them up slightly and correct the pitch. But instead of taking these to the bolt-cutting department, which would mean delay, as well as two extra handlings of the bolts, they are straightened up in the small portable lathe shown in Fig. 6, which can be placed anywhere on the bench with air pressure available. The headstock of this little chasing lathe consists of a small air motor carrying a chuck to receive the square head of the bolt and an old tail center from a miller, both being bolted to an iron plate or bed. Behind this is mounted a very simple fox or chasing device, carrying a chaser of the correct pitch and which requires no leader as in the case of the fox lathe, as it is only necessary to true up the threads which have been bruised or stretched.

This makes a very efficient little machine that handles these bolts with remarkable rapidity so that practically no time is lost and there is no running to other departments, which too often means delay.

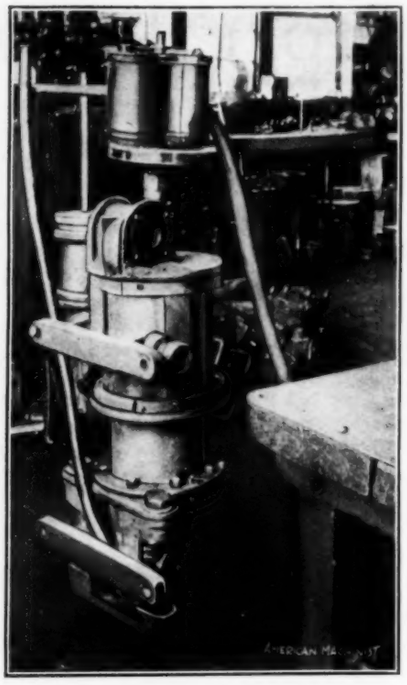


FIG. 7. GRINDING AIR-PUMP VALVES

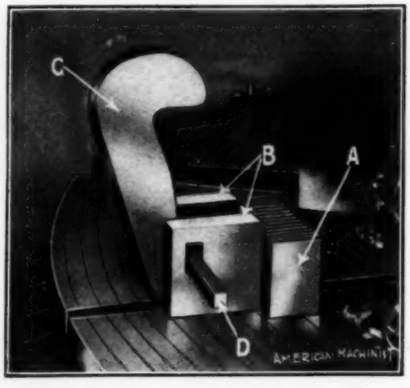


FIG. 8. SPECIAL FORM OF CLAMP

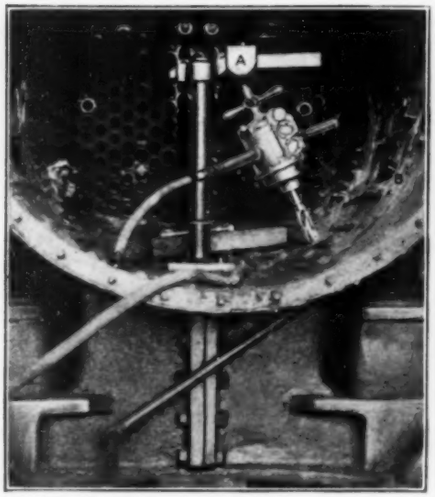


FIG. 9. A CONVENIENT FORM OF "OLD MAN"

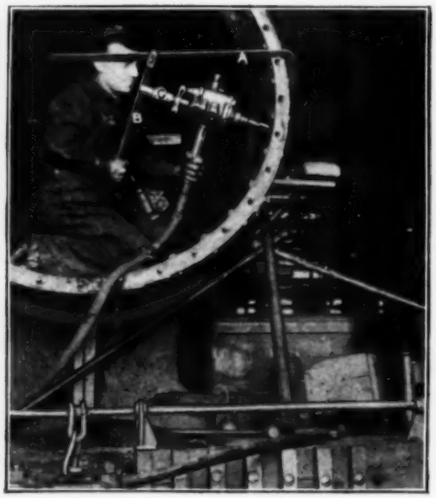


FIG. 10. A LIGHT PORTABLE-DRILL BRACE

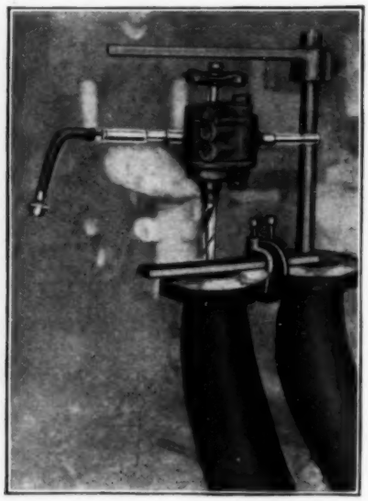


FIG. 11. DRILLING DRY PIPE FLANGES

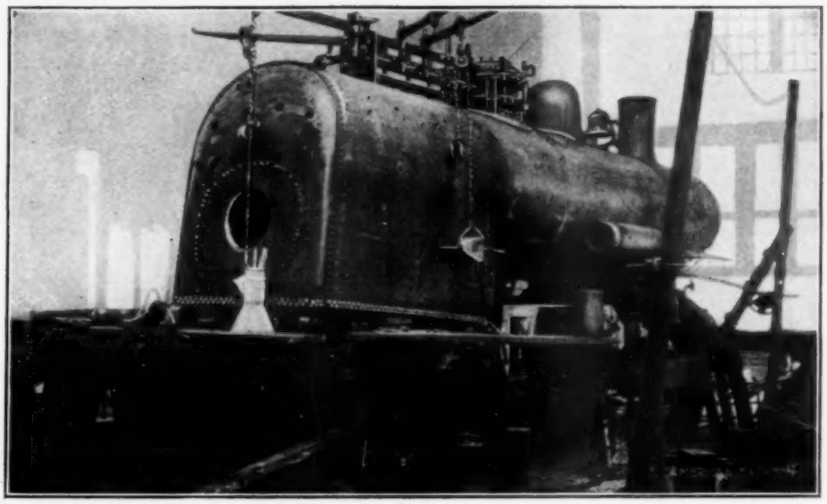


FIG. 12. CRANES FOR THE AIR TOOLS

A PORTABLE AIR MOTOR AND A SUBSTANTIAL FORM OF CLAMP

Fig. 7 shows a useful device which is simply a regular air motor used for grinding valve seats on air pumps while

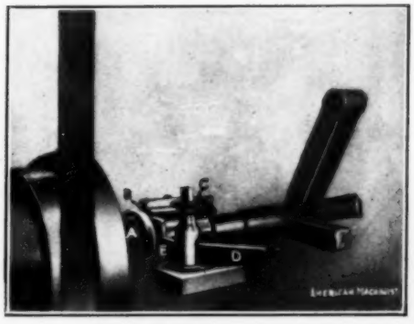


FIG. 13. TURNING THE ENDS OF A TUMBLING SHAFT

they are going through the shop for repairs. The device requires no explanation and is in use in a number of railroad shops.

A very substantial form of clamp for holding driving-wheel tires on the boring-mill table is shown in Fig. 8. The block *A* fits in the table slot being held down

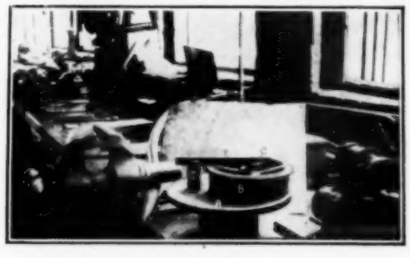


FIG. 14. LOCATING THE KEYWAY IN A CENTRAL POSITION

by a bolt. After the tire is laid on the supporting edges *B* the clamping jaw *C* is put over it and drawn down solidly by the taper pin *D*, holding it firmly in place while it is being bored.

THREE PORTABLE DRILLING JOBS

Three different applications of the "old man," each modified to suit special conditions are shown in Figs. 9, 10 and 11. Fig. 9 shows the front end of the locomotive where holes have to be drilled at various angles, where it is not always easy to place the portable air drills. In this case the arm of the "old man" carries the block or anvil *A*, which has the lower end turned to a sort of hemisphere and a number of fairly deep grooves turned in this at various points. In addition to this there are substantial countersunk holes made by the point of a drill all around in these grooves, which effectively prevent any slipping of the feeding center at the back end of the drill. In the illustration the air drill is being supported by one of the holes near the center of the block; but they are frequently used at a very decided angle, such as would be had if the drill point was swung up to the point *B*. In that event the feeding center would be placed in one of the upper rings instead of down near the center, as in this case. It has a wide range of application and could be used to advantage in many places.

For smaller work the lighter and more portable machine is used as in Fig. 10. It consists of the hook *A*, the lever *B*, and the bearing piece *C*, the whole thing being so light as to be easily handled even in very awkward positions. In this case the drill feed is secured by the lever *B* instead of the regular feed screw which must be used on heavier work.

A third application of an "old man" of the regular type is shown in Fig. 11, where the flanges on the end of dry pipes are being drilled in the erecting shop instead of being taken to the machine shop.

While it is quite probable that the actual drilling could be done much more quickly under a vertical driller, the time and cost of handling these to and from the machine shop, as well as the tying up of a driller, must be considered in figuring up the total cost.

SMALL GIB CRANES

Fig. 12 shows a very complete system of small gib cranes for supporting air tools being used around a boiler in drilling out stay bolts and similar work. The support for these cranes is stacked around the dome as can be seen, and the other crane work resting on top of the firebox. There are three small gibs on each side and one on the end, making supports for seven tools and allowing seven operators around the firebox, which makes for rapid work. Each crane carries a small trolley and by using counterweights as shown, the drills can be easily handled by the men so that more work is accomplished.

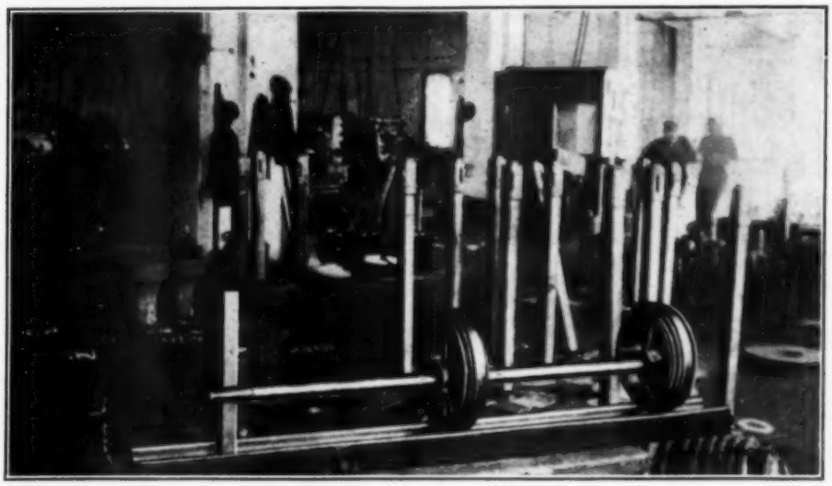


FIG. 15. LINING UP PISTON SPIDERS

TURNING TUMBLING SHAFT ENDS

Anyone who is familiar with the shape of a locomotive tumbling shaft knows what an awkward affair it is to handle in the lathe. So, instead of attempting to swing the whole shaft, which would re-

quire a very large lathe, a special turning tool, shown in Fig. 13, has been devised for turning the end for the bearings, while the shaft itself remains stationary. First, a substantial mandrel *A* is screwed on the nose of the lathe spindle and this carries a sleeve having a long bearing and a deep groove at the back end, as seen at *B*. It also carries the projecting toolholders *C*, carrying the turning tool, which is sufficiently rigid to take a fairly heavy cut. The piece *D* is clamped in the tool post and carries a broad bronze wing *E*, which fits in the groove at the back end of the sleeve, so that the turning tools can be driven by the key in the mandrel and in a slot inside the sleeve and at the same time the feed of the lathe carriage moves the cutting tool along over the journal on the end of the awkward tumbling shaft.

Locating Keyways

An easy method of locating the keyways in the hub of the piston-valve spider is shown in Fig. 14. Here is the cast-iron plate *A* having a recess bored in its face, into which the piston-valve spider *B* fits and carrying the short shaft *C* so that when the spider is placed in position, it cannot enter the depression until it is in its right position.

The top of the pin *C* and also of pin *D* are slotted to receive the straight edge *E*. After the spider is in place, it is only necessary to drop the bar *E* into the two slots and locate the correct position for the keyway in hub of the spider.

Lining up Piston Spiders

Fig. 15 shows a simple method of locating the two heads or spiders of piston valves on the valve rod. As will be seen, this rod is eccentric with the head, and it is very necessary that the two spiders should be in relatively the same position. The device consists simply of two edges or ways on which the edges of the spiders rest, and with the valve rod in place and a straight-edge through the keyway at the tapered end, it is very easy to roll the spiders until they are both alike with the piston rod at either the highest or the lowest point.

An Old Open Side Planer

By Fred H. Colvin

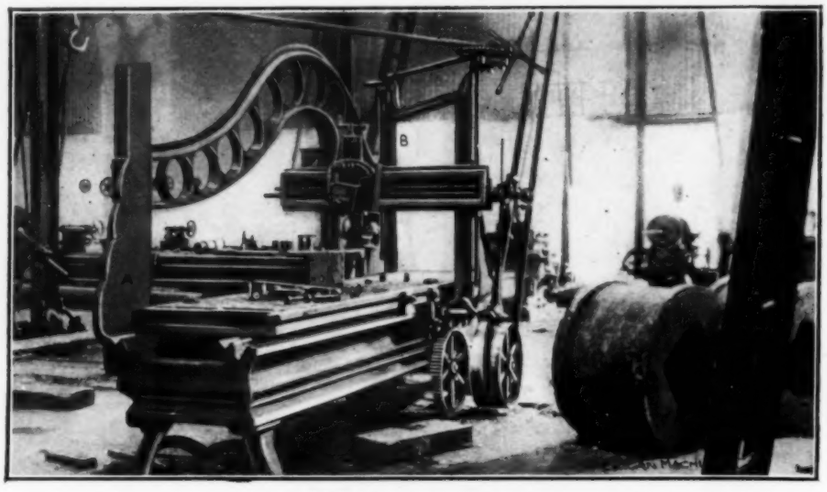
A splendid example of how little we know of machine-tool history and how soon we forget, is that of the open-side planer illustrated herewith. I have flattered myself that I had a pretty fair idea of at least the types of machine tools which had been built in Massachusetts and yet here is a fearful and wonderful example of planer design that I had never heard of.

This I discovered in the repair shop of the Providencia Sugar Mill Company, Providencia, Cuba, about 40 miles west of Havana. It was patented and built by G. Van Horn, Springfield, Mass., 1856, the patent being issued in August.

The solid housing on the right is not stiff enough to do any harm, while the other end of the rail is supported by a vertical surface on the inside of the curved brace. The ends of this graceful support are fastened to upright *A* and *B* at each of the other sides of the planer bed. The three uprights are tied together by the rods shown, which also operate bevel gears when induced to do so by the four-spoked handwheel at the top of the main upright.

The convenience of such an arrangement can be readily imagined and the stiffness of the outer support is an open question. The planer had an angle plate fastened to the bed and gave every appearance of having been recently used.

Perhaps some of the older machine builders of New England can give us more light on the history of the machine.



An Old Open-side Planer

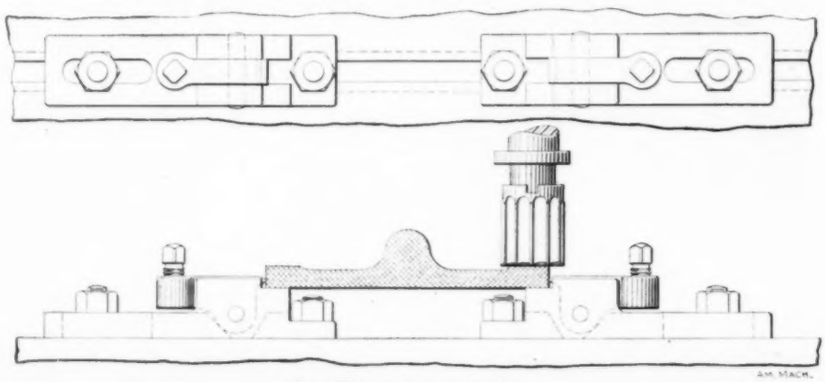
Clamping Dogs

By G. W. Linn

Quite a lot of time is wasted in shops by the workmen having to hunt bolts and straps for clamping work on the various machines.

A supply of clamping dogs, as shown, will eliminate a great deal of this loss, beside furnishing a quick-acting holding device for thin castings that would otherwise be hard to hold.

On very long and very wide castings several dogs should be used. While these dogs are particularly useful on planers and millers, they can be used on other machines to advantage.



The Work and the Dogs

In subjecting specimens of spontaneously disintegrated aluminum to microscopical examination, Le Chatelier, in the *Revue de Métallurgie*, explains that he has discovered distinct indications of cellular structure. The cause is not yet ascertained, but is believed to be due to excessive reheating during the process of working the metal (stamping into messtins, etc.) or to crystallization at ordinary temperatures, especially when the metal contains impurities, such as calcium. Once the cellular structure makes its appearance it may easily become extended by the action of reagents—even hard water—or by mechanical stresses due to fluctuations of temperature. Disintegration has also been traced to the effects of cold working, in which case reheating to 450 degrees Centigrade affords a remedy. This circumstance points to the risk attending endeavors to harden metals in general under cold working conditions.

Automobile Engine Bearing Pressures

By G. W. Lewis

Maximum unit bearing pressures for wrist-pin, crank-pin, front, center and rear bearings of automobile engines; also average rubbing speeds.

These unit pressures represent average American practice and are tabulated for four maximum explosion pressures; namely, 250, 300, 350 and 400 pounds per square inch.

In determining the average maximum unit bearing pressure on automobile-engine bearings, the first consideration is the maximum explosion pressure to which the bearings are subjected.

The maximum explosion pressure depends upon the compression pressure, form of combustion chamber, location of spark, intensity of spark, quality of charge and the temperature of the cylinder walls.

The Compression Pressure

The average compression pressure used by 30 representative American engines was found to be a little over 75 pounds gage and varied from 50 to 90 pounds gage. From manograph cards of Franklin, Pierce and Thomas automobile engines, the average compression pressure was found to be 70 pounds gage.

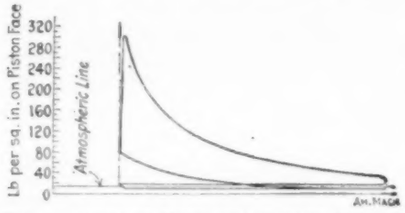


FIG. 1. AVERAGE CARD OF AVERAGE ENGINE

The average pressure ratio; that is,

$$\frac{\text{Max. explosion pressure abs.}}{\text{Compression pressure abs.}}$$

from manograph cards equaled 4, and varied from 3.5 to 4.5. The pressure ratio for all engines varied between 3 and 5, with an average of 3.5.

Assuming 75 pounds gage as the average compression pressure, the corresponding maximum explosion pressures using the pressure ratios of 3.5 and 4 would be 300 and 345 pounds gage. The value, 350 pounds gage, is generally used in determining stresses in automobile-engine parts, although the average explosion pressure occurring in the cylinder is considerably less.

Fig. 1 shows the average card from an average engine, assuming a maximum explosion pressure of 300 pounds per square inch gage, a compression pressure of 77 pounds per square inch gage, an exhaust pressure of 17 pounds per square inch absolute, and a suction pressure of 9 pounds per square inch absolute.

The maximum explosion pressure may be much larger than that computed, as the ignition may be defective, causing several unexploded charges to be drawn into the cylinder, and these, when ignited, will give an unusually high explosion pressure.

A combustion chamber free from valve pockets or dead spaces, and approaching a spherical shape, as that used in the Silent Knight engine, should give the highest maximum explosion pressure.

The spark should be located as near the center of the combustion chamber as practical, which condition is also very closely approached in the Knight engine. The temperature of the cylinder, or temperature of the charge is proportional to the maximum explosion pressure. Note the manograph cards, Fig. 2, of the air-cooled and water-cooled engines, the air cooled with hot cylinder walls and the other, water cooled, with comparatively cool walls.

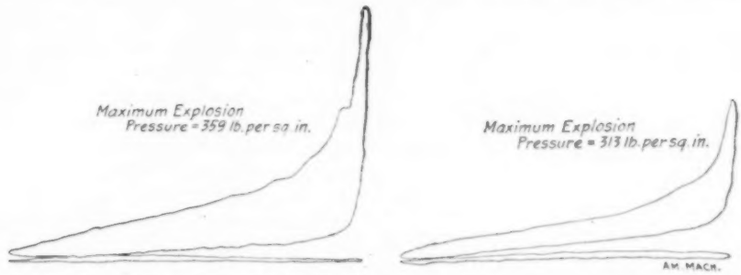


FIG. 2. MONOGRAPH CARD OF AIR-COOLED AND WATER-COOLED ENGINES

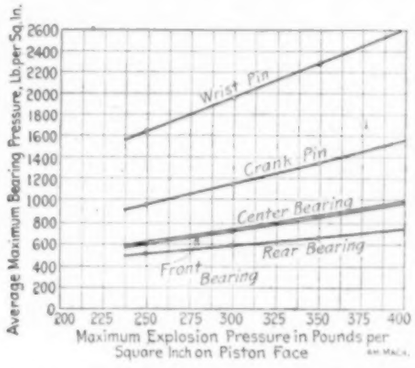


FIG. 4. AVERAGE MAXIMUM UNIT BEARING PRESSURES

In the following computations the average maximum bearing pressures have been determined for explosion pressures of from 250 to 400 pounds per square inch, which range includes all types of engines.

Fig. 3 shows the variation of total pressure for the four strokes on the wrist and crank pins of a 4½x5-inch engine. It is apparent from this that the total resultant pressure is the sum of the gas pressure in the cylinder and the pressure due to inertia forces, the greatest pressure occurring on the expansion or explosion stroke.

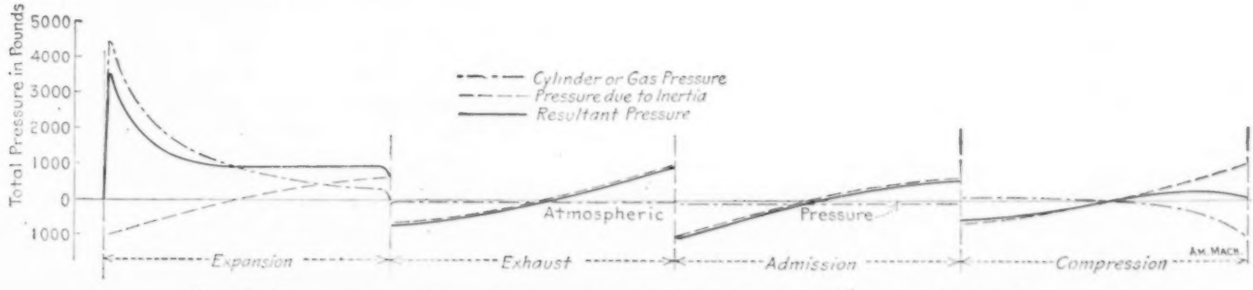


FIG. 3. VARIATION OF TOTAL PRESSURE FOR FOUR STROKES ON WRIST AND CRANK PINS

D	4	4½	5	5½	
D_{wp}	⅞	1	1 3/16	1⅜	From equation (1)
L_{wp}	2	2.25	2⅜	3 1/16	From equation (2)
A_{wp}	1.75	2.25	3.12	4.2	$D_{wp} \times L_{wp}$
P_m	—250—				Assumed
K_{wp}	1800	1780	1570	1420	Equation (A)
P_m	—300—				Assumed
K_{wp}	2150	2130	1890	1700	Equation (A)
P_m	—350—				Assumed
K_{wp}	2510	2480	2200	1980	Equation (A)
P_m	—400—				Assumed
K_{wp}	2870	2840	2510	2270	Equation (A)

D = Cylinder diameter in inches.
D_{wp} = Bearing diameter of wrist pin in inches.
L_{wp} = Bearing length of wrist pin in inches.
A_{wp} = Projected bearing area of wrist pin in square inches.
P_m = Maximum unit explosion pressure.

$$D_{wp} = 0.34\ D - 0.53 \text{ inch} \quad (1)$$

$$L_{wp} = 2.25\ D_{wp}. \quad (2)$$

K_{wp} = Maximum unit bearing pressure.

$$K_{wp} = \frac{P_m \times D^2 \times 0.7854}{A_{wp}} \quad (A)$$

TABLE 1. MAXIMUM UNIT WRIST PIN BEARING PRESSURES

D	4	4½	5	5½	
D_{cp}	1 9/16	1¾	1 15/16	2 1/16	From equation (3)
L_{cp}	2¼	2⅝	2½	2⅞	From equation (4)
A_{cp}	3.32	4.17	4.68	5.68	$D_{cp} \times L_{cp}$
P_m	—250—				Assumed
K_{cp}	945	960	1050	1050	Equation (B)
P_m	—300—				Assumed
K_{cp}	1130	1150	1260	1260	Equation (B)
P_m	—350—				Assumed
K_{cp}	1320	1350	1470	1470	Equation (B)
P_m	—400—				Assumed
K_{cp}	1510	1540	1675	1675	Equation (B)

D = Cylinder diameter in inches.
D_{cp} = Bearing diameter crank pin in inches.
L_{cp} = Bearing length crank pin in inches.
A_{cp} = Projected bearing area crank pin in square inches.
K_{cp} = Maximum unit bearing pressure on crank pin.
P_m = Maximum unit explosion pressure.

$$D_{cp} = 0.32\ D + 0.3 \text{ inch} \quad (3)$$

$$L_{cp} = 1.35\ D_{cp} \quad (4)$$

$$K_{cp} = \frac{P_m \times D^2 \times 0.7854}{A_{cp}} \quad (B)$$

TABLE 2. MAXIMUM UNIT CRANK PIN BEARING PRESSURES

Wrist or Piston-pin Bearing Pressures

The equations used in determining sizes of bearings are average empirical equations, derived from the dimensions of some 30 American automobile engines.

Table 1 gives the average dimensions of wristpin bearings, computed from equations (1) and (2), for cylinder sizes of 4, 4½, 5 and 5½ inches, which covers the range of engine sizes in average cars. Then assuming maximum explosion pressures of 250, 300, 350 and 400 pounds per square inch (gage) on the piston face the corresponding average maximum unit bearing pressures were computed. From the table it will be seen that the average maximum unit bearing pressure will run from 2000 to 2500 pounds per square inch, which may seem very high, but is permissible when consideration is taken of the very low rubbing speed.

Crank-shaft Bearing Pressures

The following tables are computed for the average crank shaft found in American practice—the four-throw, three-bearing crank shaft. Here also the bearing dimensions are computed from empirical equations obtained from average practice.

Average Maximum Bearing Pressure on Crank Pin

Table 2 gives the average dimensions of crank-pin bearings of four-throw, three-bearing crank shafts for cylinders of 4, 4½, 5 and 5½ inches—computed from equations (3) and (4). From these dimensions the average maximum bearing pressure is computed for maximum explosion pressures of 250, 300, 350 and 400 pounds per square inch (gage).

In Table 2 the maximum unit bearing pressures are high, but this is necessary, as the bearing length is restricted, the cylinders being generally cast in pairs, which condition limits the distance between the center lines of the crank throws.

In a single-cylinder engine the bearing pressures are still higher, averaging 1.25 more than the pressures computed in Table 2. In the single-cylinder engine the crank pin can be made much smaller in diameter as the distance between bearing supports is considerably less and the rubbing speed is correspondingly decreased, permitting of an increased unit bearing pressure.

In the two-throw, two-bearing crank shafts the bearing pressures are approximately the same as computed in Table 2.

In the four-throw, two-bearing shafts the distance between supports is very great and the crank pin must be made correspondingly large. This increases the rubbing speed so that the average maximum unit bearing pressure becomes about 0.75 of that computed in Table 2. All other types of crank shafts would be a combination of either the single-throw, two-bearing or two-throw, two-bearing types discussed above.

D	4	4½	5	5½	
D_{cb}	$1\frac{9}{16}$	$1\frac{3}{4}$	$1\frac{7}{8}$	$2\frac{1}{16}$	From equation (5)
L_{cb}	$2\frac{1}{16}$	$2\frac{3}{4}$	$3\frac{1}{16}$	$3\frac{3}{4}$	From equation (6)
A_{cb}	3.42	4.8	5.75	7.5	$D_{cb} \times L_{cb}$
P_m	—250—				Assumed
K_{cb}	690	615	620	575	
P_m	—300—				Assumed
K_{cb}	830	730	750	690	
P_m	—350—				Assumed
K_{cb}	970	855	870	810	
P_m	—400—				Assumed
K_{cb}	1100	980	1000	920	

D = Cylinder diameter in inches.
D_{cb} = Bearing diameter of center bearing in inches.
L_{cb} = Bearing length of center bearing in inches.
A_{cb} = Projected bearing area of center bearing in square inches.
K_{cb} = Maximum unit bearing pressure on center bearing.
P_m = Maximum explosion pressure in pounds per square inch of piston face.

$$D_{cb} = 0.32\ D + 0.3 \text{ inch} \quad (5)$$

$$L_{cb} = 2.8\ D_{cb} - 2.2 \text{ inches} \quad (6)$$

TABLE 3. MAXIMUM UNIT BEARING PRESSURE ON CENTER BEARING

D	4	4½	5	5½	
D_{fb}	$1\frac{9}{16}$	$1\frac{3}{4}$	$1\frac{7}{8}$	$2\frac{1}{16}$	From equation (7)
L_{fb}	$2\frac{11}{16}$	$2\frac{7}{8}$	3	$3\frac{3}{16}$	From equation (8)
A_{fb}	4.2	5.02	5.63	6.6	$D_{fb} \times L_{fb}$
P_m	—250—				Assumed
K_{fb}	560	595	640	670	
P_m	—300—				Assumed
K_{fb}	665	710	775	800	
P_m	—350—				Assumed
K_{fb}	780	830	900	930	
P_m	—400—				Assumed
K_{fb}	890	945	1030	1075	

D = Cylinder diameter in inches.
D_{fb} = Bearing diameter of front bearing in inches.
L_{fb} = Bearing length of front bearing in inches.
A_{fb} = Projected bearing area of front bearing in square inches.
K_{fb} = Maximum unit bearing pressures on front bearing.
P_m = Maximum explosion pressure in pounds per square inch of piston face.

$$L_{fb} = 0.32\ D + 0.3 \text{ inch} \quad (7)$$

$$L_{fb} = D_{fb} + 1\tfrac{1}{4} \text{ inches} \quad (8)$$

TABLE 4. MAXIMUM UNIT BEARING PRESSURE ON FRONT BEARING

The present tendency in crank-shaft design is toward rigidity and consequent quiet running, which means larger bearings with supports on each side of the crank pin.

Maximum Unit Bearing Pressure on Intermediate Journal or Center Bearing

The average dimensions of the center bearings for four-throw, three-bearing crank shafts, for cylinder diameters of 4, 4½, 5 and 5½ inches, are given in Table 3. From these dimensions and the dimensions from center line of center journal to center line of nearest crank-pin bearing (computed from empirical data), the average maximum unit bearing pressures were calculated for explosion pressures of 250, 300, 350 and 400 pounds per square inch.

Average Maximum Unit Bearing Pressure on Front Bearing

Table 4 gives the average maximum unit bearing pressure on the front or forward journal of crank shafts for cylinders of 4, 4½, 5 and 5½ inches and for explosion pressures of 250 to 400 pounds per square inch. The bearing dimensions were determined from equations (7) and (8) and the distances between center line of front bearing and center line of nearest crank pin determined from emperical data.

Maximum Unit Bearing Pressure on Rear Bearing

Table 5 gives the average maximum unit bearing pressure on the rear bearing computed from equations (9 and (10) and the dimensions from center line of rear bearing to center line of nearest crank pin. In this case the weight of the flywheel must also be considered and the following flywheel weights were consequently used:

Cylinder diameter, inches	4	4½	5	5½
Flywheel weight, pounds	80	90	100	110

It will be noted from Table 5 that the maximum unit bearing pressure on the rear bearing is considerably less than on the front bearing. This maximum pressure on the rear bearing is increased slightly provided the weight of the flywheel clutch is considered—which was *not* done in this case.

The curves Fig. 4 shows the average maximum unit bearing pressure on bearings for all sizes of engines.

Curve (1) gives the average maximum unit bearing pressure on wrist pins for explosion pressure of 250 to 400 pounds per square inch.

Curves (2) (3) (4) and (5) give the average maximum unit bearing pressures on crank pins, center bearings, front and rear bearings for four-throw, three-bearing crank shafts (for cylinder sizes from 4 to 5½ inches and maximum explosion pressures of 250 to 400 pounds per square inch).

Table 6 gives the average rubbing speeds computed for a piston speed of 1000 feet per minute. Assuming an average pressure for the entire cycle of 20 pounds per square inch of piston face the work of friction on the bearings is calculated and the average for each bearing shown in Table 6.

D	4	4½	5	5½	
L_{rb}	1⅝	1¾	1⅞	2 1/16	From equation (9)
L_{rb}	3	4	4½	5⅝	From equation (10)
A_{rb}	4.7	7	8.67	11.6	$D_{rb} \times L_{rb}$
P_m	—250—				Assumed
K_{rb}	565	495	495	465	
P_m	—300—				Assumed
K_{rb}	660	575	575	535	
P_m	—350—				Assumed
K_{rb}	760	660	655	605	
P_m	—400—				Assumed
K_{rb}	855	735	735	675	

D = Cylinder diameter in inches.
D_{rb} = Bearing diameter of rear bearing in inches.
L_{rb} = Bearing length of rear bearing in inches.
A_{rb} = Projected bearing area of rear bearing in square inches.
K_{rb} = Maximum unit bearing pressure on rear bearing.
P_m = Maximum explosion pressure in pounds per square inch of piston face.

$$D_{rb} = 0.32\ D + 0.3 \text{ inch} \quad (9)$$

$$L_{rb} = 5.3\ D_{rb} - 5.3 \text{ inches} \quad (10$$

TABLE 5. MAXIMUM UNIT BEARING PRESSURE ON REAR BEARINGS

						Average
	D	4	4½	5	5½	
	L	4¾	5	5½	6	
	$R.p.m.$	1370	1200	1090	1000	
	Rubbing speed in ft. per min. on bearings	560	550	535	540	546
	V	9.35	9.15	8.9	9	9.1
	P_{mean}	252	320	395	475	
Crank Pin	K_m	76	77	84	84	80
	W	710	705	745	755	729
Center Bearing	K_m	55	49.2	49.8	46	50
	W	515	450	445	415	456
Front Bearing	K_m	44.7	47.5	52	53.4	49.4
	W	418	435	462	480	449
Rear Bearing	K_m	56	45.5	43.5	38	45.7
	W	523	415	388	342	417

D = Cylinder diameter in inches.
L = Stroke in inches.
P_{mean} = Mean total pressure on piston, for entire cycle (assumed).
$R.p.m.$ = Revolutions per minute at 1000 feet per minute piston speed.
K_m = Mean unit bearing pressure on bearings.
V = Rubbing speed in feet per second.
W = Work of friction = ($K_m \times V$) in foot pounds per second.
L = 1.1 D (11).

TABLE 6. AVERAGE RUBBING SPEED FOR AUTOMOBILE BEARINGS

A Milling Fixture

By D. A. Charles

The milling fixture shown here is of a standard type in wide use by several large companies, where hundreds of these fixtures are in daily use and giving complete satisfaction.

The part *A* shown in position in the fixture could be milled in a pair of ordinary milling-machine vise jaws, but the principle of such jaws is incorrect for accurate work, due to the fact that the weight of the cutting is borne by the loose or movable jaw, whereas in the fixture the cutting and also the clamping of the part to be milled is against the solid jaw.

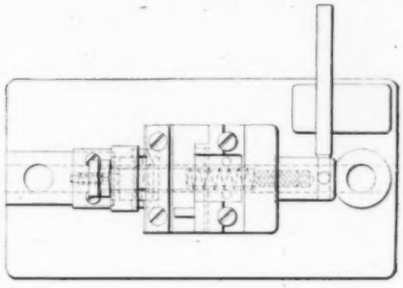
Many of the parts for these fixtures are of a standard size, made up in quantities, and various-sized castings for the bodies are also kept in stock, selection being made from them to suit the work in hand.

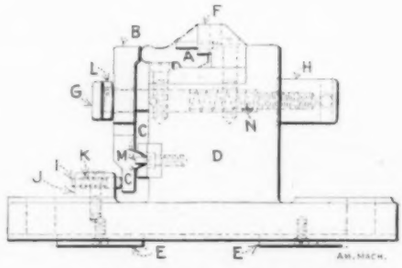
The construction is such that chips do not give the least trouble in operation, and the fixture may often be seen almost buried under a pile of chips, but so long as the bearing points are kept clean, the fixture will continue to operate.

An important point to be borne in mind in making this fixture is to see that the lower bearing of the clamp *B*, at *C*, is set out beyond the end of the piece being milled by at least 1/32 inch, as this insures the clamp having a slight downward movement, thus holding the work down as well as clamping it. If this lower bearing is inside the work to be milled, it will have a lifting tendency on the part being milled, and the vibration of the cut will tend to loosen the work.

The base casting *D* is provided with the usual tongues *E* for fitting the slots in the miller table and the top part is cut away for suitable locating blocks, as at *F*. The piece is held between this block and clamp *B* by tightening bolt *G*, by means of nut *H*.

The clamp is kept in contact with the V-block at all times by the plunger *I*, contained in block *J* and operated by spring *K*. The washer *L* is chamfered on both sides, to allow the clamp to rock in all directions and thus make up for any slight irregularities in the piece being milled. Provision for rocking is also





THE MILLING FIXTURE

made on the lower bearing of the clamp and the V-block has two pins *M* for preventing the clamp from swinging sideways. When the bolt is released by loosening nut *H*, the clamp is forced open by the spring *N*.

The foot has been the most widely used measure of length, both in ancient and in modern times. It was derived, as the name suggests, from the length of the human foot, and is thus a natural unit like the second; but, owing to the multiplicity of human feet and their varying dimensions, this unit has varied greatly in different countries and in different ages, its length ranging all the way from the ancient Welsh foot of 9 inches to the Piedmont foot of 20 inches. In modern times it has varied from the Spanish foot of less than 11 inches to the Venice foot of over 13 inches, almost every country using a foot of different length.

Machining Locomotive Cylinders and Axles

By M. E. Hoag

In my article, "Machining Cylinders and Eccentrics," page 435, Volume 34, I described some of the methods and special tools in use at the Davenport Locomotive Works, but at that time it was impossible to secure photographs of all the machines and operations, owing to the unsettled condition of the new shops.

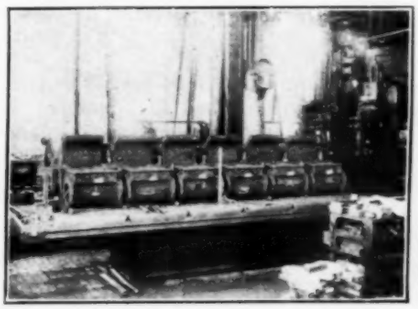


Fig. 1. Planing Six Cylinders

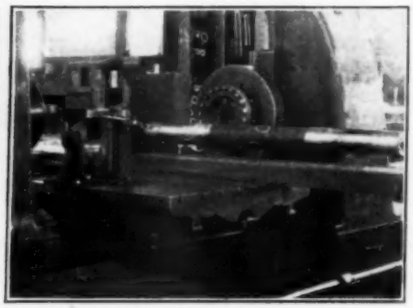


Fig. 2. A Driver Axle

By referring to the former article the reader will note that mention was made of planing cylinders *before* boring; and of quartering and keyseating the driver axles in a special fixture. These, together with a general view of the new shops, are shown in the accompanying illustrations.

Fig. 1 shows the method of gaging six cylinders on a Gray planer, three tools being in operation at once, two on the cross rail and one on the side rail. By this method of handling, the work is turned out in short order, and with the result that the cylinders are interchangeable.

In Fig. 2 will be seen a driver axle quartered and keyseated ready for the drivers and eccentrics. For this operation a plain arbor and cutter are used, but are not shown; for the Lucas miller on which this work is handled was set up for a slabbing job, and only the indexing fixture and axle were put in place. After operating on one end of the axle the fixture is reversed on the machine and the ways on the opposite end cut. It will be noticed that the work is located by suitable slots in the index head, together with a stop that fits these slots and the keyways already cut.

Immediately in front of this fixture, on the machine table, is shown a fixture for boring driver-axle boxes. After properly locating the fixture and arbor support, the boxes are dropped into the fixture and held in position by suitable clamps, and a suitable cutter passed through.

Fig. 3 gives a general idea of the assembling floor, and machine bay on the right. The small inclosures near the center of the photograph are the tool crib and office.

At the extreme lower end of the shop are located the large planers, slotters and frame driller, all of the latest standard makes. These machines are operated by individual electric drive, and special attention has been given to their respective locations, in order that the work may be routed through the shops with the least possible handling and moving.

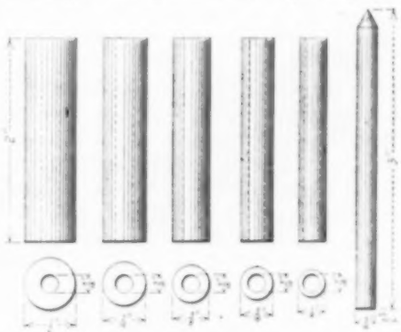
Fig. 3. The Assembling Floor—Machine Tools in the Background

Diemakers' Prick Punch

By Linton Collins

Here is a diemakers' prick punch which I have found to be very useful. It is merely a set of bushings made in sizes that are most frequently used, with a hole through the center, the same size in all the bushings so that one prick punch can be used in any bushing.

Its value is appreciated when one has some holes to lay off from holes already drilled in a piece. For instance, a diemaker has a die finished and wishes to fit it in the shoe; he planes up the shoe and lays the die on it, then he takes a bushing the size of the screw holes in the die and inserts the bushing in the hole; then he takes the prick punch and prick punches the shoe through the hole in the bushing; that gives him a prick-punch mark that is perfectly central with the hole in the die. He can continue to do this until all of the holes have been transferred into the die shoe. And he will find a vast number of places he can use this tool to advantage after he becomes accustomed to using it.



A Diemakers' Prick Punch

Central Control

There are seven separate steam plants in a certain manufacturing company. Each has its chief engineer who has complete control of his plant and is responsible to no particular head. Each one does his work to suit himself, and if he finds a method of reducing operating expenses he keeps it to himself rather than inform his associates; as a result the company suffers a loss.

What is everybody's business is nobody's business, and this truism is evident in the case cited. If a chief engineer were in charge of all of these steam plants the improved methods adopted in one would be applied to all and the company would be benefited. Further, each acting chief would try to make a good showing, and such rivalry would be beneficial.

Compressed Air in the Machine Shop

By Frank Richards

Compressed air is called "the last duck of the machinist" for it is contended that machinists have not fully acquired the compressed-air habit.

The simile of the last duck was used by a writer in the AMERICAN MACHINIST many years ago in connection with some other matter. You know that in the big rivers of China there are many who live in boats and who keep lots of ducks. These ducks are allowed to swim away in the morning and to be gone all day, picking up their living, but they are all sure to return with a rush when night comes or when the owner calls them, because the last one is sure to get a whipping.

The AMERICAN MACHINIST, without any formal or conscious recognition of the fact, has kept up the whipping of the last machine-shop duck through all the years of its existence. The thing which has been most incorrect or inefficient in practice has constantly been set right and urged forward, until now there is such a general uniformity of efficiency all through the details of machine-shop practice that there might be some question at the moment as to what most requires to be castigated for its delinquency, although I have little doubt about it.

In very recent years it has come in my way to offer a word or two here and there about compressed air, and usually in advocacy of its general and more extensive employment. My present breaking out is decidedly in the same line. There may be those who, when they have read thus far, will think they have enough, but there really is something which ought to be said, and which should be heeded and acted upon for the good of all.

If, at the present time, compressed air is not the last duck in general machine-shop practice, and requiring the treatment which a last duck should receive, where else is that duck? Knowing in a general way the capabilities of compressed air, machinists still have not fully acquired the compressed-air habit. They don't think compressed air. They do not look upon it as a working companion, a helpmeet. When they do employ compressed air for any specific purpose, it is too apt to be as a last resort. There are some things, as we know quite generally, which only compressed air can do, but there are many other things which compressed air can do better or quicker or more cheaply or with less fuss and muss than they can be done by any other agency, but this we do not so fully appreciate.

THE COMPRESSED-AIR MISSIONARY

In speaking here of the general machine shop, including its close ally the blacksmith shop, and of its too frequent lack of proper appreciation and its too infrequent employment of compressed air, both the manufacturing and the jobbing shops are included, and from the biggest down to those which are quite small; but practically all railroad shops are excluded from this category, for in all those the compressed-air missionary has been located and has done its beneficent work so thoroughly that it can never be undone. There compressed air has come into its own and can never be dispossessed.

This missionary is, of course, the air-brake pump. With these pumps or compressors always hanging around ready for a job in all railroad shops, it has been the simplest thing in the world to pipe one up and to use the air for any of the primitive compressed-air devices, as likely as not for an air hoist of some type, and then the handy air has at once made its way for other uses and has soon become indispensable. In the growing use of compressed air thus begun, it has frequently happened that one air-brake pump after another has been added, until sometimes a battery of eight or ten or a dozen has accumulated. The air-brake pump, as is conceded by all, is an extravagant and costly means of producing compressed air, though admirably adapted to the conditions of its normal employment. The steam or power cost of operating several of these pumps together has led to their replacement by standard and uptodate compressors, so that railroad shops are now among the best customers of the compressor builders.

There has recently appeared a book of railroad-shop kinks of about 300 pages, each larger than the page of the AMERICAN MACHINIST, and crowded all through with devices which have originated in railroad shops. Among these is an astonishing lot of air-operated conveniences and contrivances, all in established and successful use. These are devices which have all originated in railroad shops, have been first thought of and worked up and applied there. Most of them are equally applicable in all other machine shops, numbering, perhaps, four times as many as the railroad shops alone. These devices generally are not in the habit of being born, so to speak, in the shops other than railroad shops, because the air they breathe is not so free and plenty there.

The railroad man regards compressed air with confidence from the beginning, for he has constantly before him one of the world's greatest mechanical successes—the air brake. As a consequence he need not waste his time in hesitating as to the feasibility of any compressed-air application which may occur to him. Generally speaking, no experimenting is required. As soon as the thing is thought of it speaks for itself that it will work, and the only thing to be done is to determine the strength and sizes required and the general arrangement and adaptation of details.

COMPRESSED-AIR LEAKAGE

With the air brake so well known, and with a general knowledge of its operation which every intelligent mechanic must possess, it remains an inexplicable mystery that there should be such a persistent impression, among those who have had little directly to do with compressed air, that in the general use of it there is a considerable and constant leakage. In the presence of a modern railway train it is impossible to discuss the matter. Take a train of, say, a dozen passenger cars, or, more trying still, forty or fifty freight cars with the air pipes coupled with a snap between each pair of cars by a not over-careful trainman, with valves and joints and fittings in each car. The pressure is maintained when the train is running and rattling along with the little air-brake "pump" working less than half its time, less than a quarter of its time, probably, not to keep up this constant pressure but to replace the air which is used each time the brakes are set. If there is so little loss by air leakage on railway trains, or on the miles and miles of piping in the switch and signal service, the possible losses in an ordinary machine shop are not worth talking about.

I have referred here only to the incidental uses of compressed air which develop in shops wherever a supply of air is constantly and freely usable. Compressed air is not primarily brought into shops for this service. It has its regular line of business in driving pneumatic tools, hoists, sand blasts, etc. Many of the most highly developed and most efficient machine tools call for air under pressure to operate feed motions and automatic devices, so that no shop can be uptodate, or can avail itself of the most advanced and most profitable of modern facilities without providing and maintaining an air supply. In the matter of providing this air service it is not a question of meeting the initial expense involved; the question rather is how the greater cost of operating without the air facilities can be longer submitted to.

The shop which is not a railroad shop

has a great advantage to begin with, in that it is not tied to the steam gormandizing air-brake pump. The compressor manufacturers are now putting out machines in such great variety as to satisfy closely all requirements as to capacity, and the most suitable drive for the given conditions. Perhaps the most important thing of all in getting the first compressor is to provide one larger than the requirements in sight would suggest, for additional uses for the air will certainly develop. But after al, it will be surprising how many air-operated devices a small compressor will drive where they are only intermittently operated. Compressed air is unique in that while it is always standing ready to do its work it cosst nothing except while actually doing it.

Reversing Tapping Chuck

By John Fredette

The accompanying figures illustrate a very serviceable and compact tapping chuck of the reversible type, which is ordinarily used in drillers that are not equipped with reversing mechanism.

The shank and main body *A*, Fig. 1, is bored to receive bushing *B*, which is a ions *M* and the gear *K*. The arm *U* bolted to the plate *R* retains the pinion carrier stationary. This arm is allowed to rest against the column of the drill press or clamped to a projecting stud fastened to the drill-press table.

by means of two fiber friction washers *G*, Fig. 1. The friction is obtained by a fillister-head screw *H*, and a friction clamping plate *I*.

Reversing is obtained by an upward movement of the drill-press spindle, which disengages driving pin *E*, and engages it with the reversing gear pins *J* in the gear

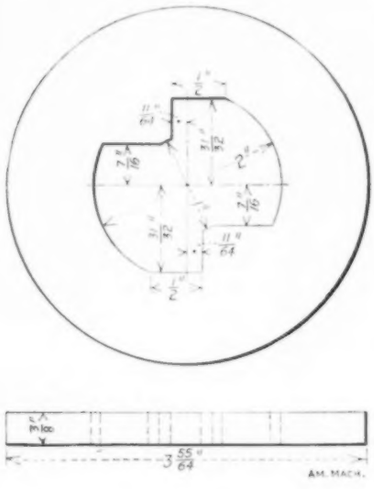


Fig. 2. Plan of Driving Plate

K, which gets its left-hand direction from the internal gear *L* actuating the four idler pinions *M*.

The plates *R* and *S* together with the four studs *T* form a carrier for the pin-tween the two pins *N*. This method of

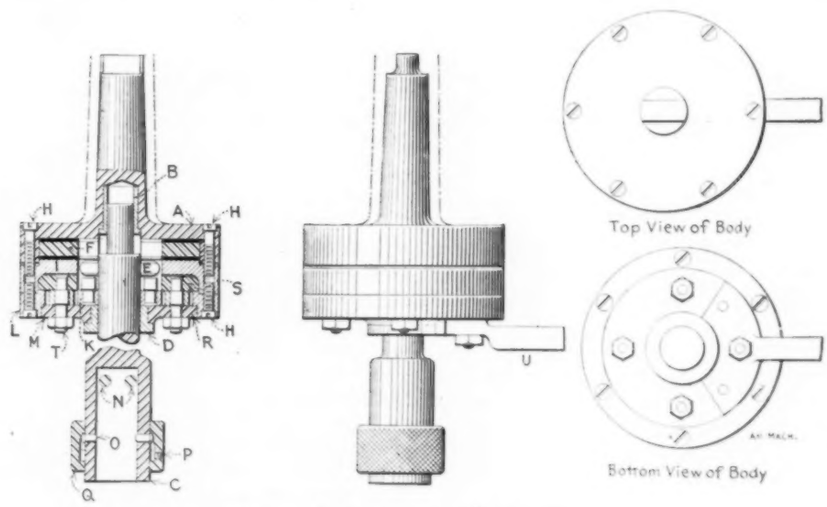


Fig. 1. Reversing Tapping Chuck

The tap is usually held in a holder of the presto type, its tang engaging beforced fit in the shank, and is the upper bearing of tap-driving spindle *C*. *D* is the lower bearing. *E* is the driving pin in spindle *C*, and is shown in its idle position. *F* is the driving plate (see plan in detail, Fig. 2). When the tap is brought against the work it pushes up the spindle *C*, engaging the driving pin *E* with the driving plate *F*. This is driven

driving holder is cheap and efficient. The two small pins *O* act as retainers for the straight-shank tap holder. To release tap holder, the collar *Q*, which is a loose fit on the spindle *C*, is pushed upward, thereby allowing the pins *O* to move into the recess in collar *Q*. To engage the tap holder the opposite operation is required.

The small screw *P* is necessary on account of a hole in the collar being required to slip pins *O* into position.

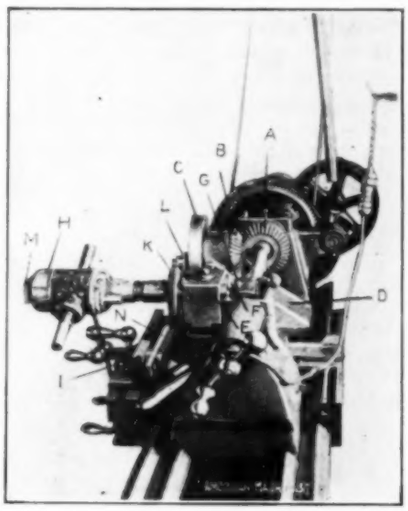
Making a Self Oiling Heavy Duty Bearing

By A. B. Sowden

We had trouble in oiling a bearing that has heavy duty to perform. We overcame the difficulty as follows:

An oil channel after receiving the oil at the starting point carries it to the other end of the bearing and then returns it; thus, the entire bearing has been lubricated.

A miter gear *A* is threaded to fit the lathe spindle. A miter gear *B* is keyed on the feed hub *C*. The feed hub has a T-slot for adjusting the length of oil channel to be cut. An angle plate *D* is bolted to the lathe shears and forms the bearing for *B* and *C*. A block *E* is bolted to the cross slide on the carriage



A Self-oiling, Heavy-duty Gearing

and forms the bearing for the spindle *F* and the dividing gear *K*. The spindle *F* has a ball-bearing thrust collar. A tool holder *G* with a taper shank screws into the spindle and is slotted to enable tightening it on the tool. An electric breast drill *H* is used to drive the gear *K* that runs a smaller gear on the spindle *F*. The milling cutter should run about 1000 revolutions per minute and the work turn as slowly as possible for a smooth finish. A plate *I* is fastened to the carriage and forms a connection with the feed hub *C*.

There is a connecting rod *N* between the feed hub *C* and the carriage. The large driving gear *K* runs a small gear on the spindle *F*. The bearing *L* connects with the feed hub *C* where the length of the oil channel is governed. A bracket *M* supports the electric drill *H*.

It can be seen that with one revolution of the work the tool travels from one end of the work to the other and returns to the starting point.

This was done at the Smith & Mills Shaper Company, Cincinnati, Ohio.

An Unusual Perforating Die

By M. Martin

This die perforates the bottoms of berry pans, making 2977 holes, 0.070 inch diameter, at each stroke of the press.

The cuts and description herewith give all particulars of construction of a perforating die used to perforate a berry pan. By it all the holes in the pan, 2977 in number, are cut with one stroke of the press, bur down on the bottom of the pan.

Heretofore the perforating was accomplished in a segment die requiring six strokes of the press. This was very unsatisfactory, as the gaging was very irregular, and the die was continually shifting and shearing the punches, as it was found impracticable to attach sliding dowel pins to insure proper alinement of punches and die in cutting, etc.

The Pan

Fig. 1 is a view of the berry pan, made of what is known as 90-pound tin, and is taper, 2½ inches deep. The holes are in circles, of which there are 31 (not including the center hole), each circle increasing by six (6) holes, from 6 to 186 holes to a circle; each circle 0.160 inch apart, and each hole 0.070 inch diameter. Taking into consideration that the bur has to be on the outside of the pan, the problem involved to do this was somewhat difficult. The dimensions as given, represent the exact size of pan.

The Die and Punch

Fig. 2 is a view of the die and punch, showing the major features, and includes the press bolster to which the die is fastened in the usual manner. This bolster has a hole slightly larger than the outer row of holes in the die, to insure the punchings dropping freely. *A* is a cast-iron die bolster, or shoe, machined to take the cutting die *B* and reinforcing plate *C*, having a shoulder at A^1 to support both. The cutting die *B* is a composite-forged disk, having a high grade of tool steel welded to an *open-hearth steel* back in place of wrought iron, as is customary. The reason for using open-hearth steel instead of wrought iron was to avoid the hard and sandy spots in the latter material, and to facilitate the drilling of the small holes necessary, which was accomplished without any serious difficulty. This disk was machined as shown, the upper or cutting face having a "set edge" B^2, which centers the pan. Flat-head screws and dowel pins were used to secure it in position.

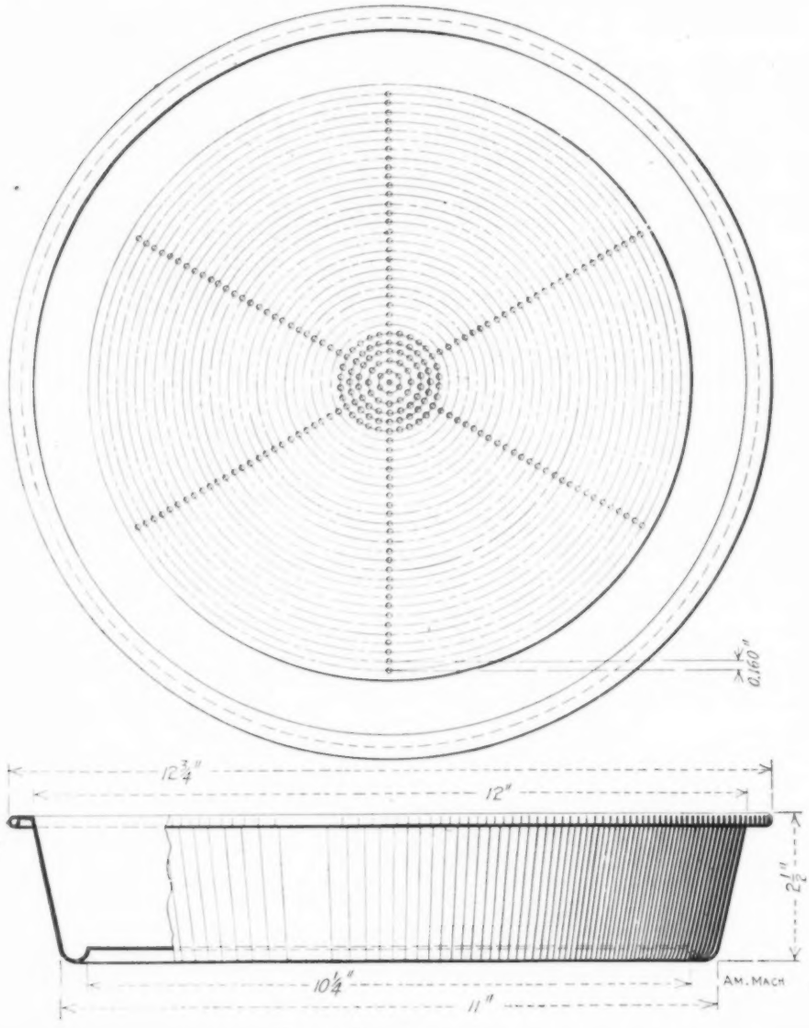


Fig. 1. The Berry Pan

Spacing the Holes

After the disk was prepared with screw holes, it was fastened to a special face-plate that had been made to fit the dividing head of the miller, and the holes of each circle spotted by the use of the index, and the moving of the table a distance of 0.160 inch for each circle. The disk was then removed and the holes drilled through very carefully in a sensitive driller, with a drill three sizes under finished size, after which the plate was reversed and the holes enlarged to ⅜ inch of cutting face by a drill three sizes over finished size. These clearance holes at the back were then reamed to this shoulder by a special reamer, which was made for the purpose, so that the clearance holes were absolutely smooth, and did not show any ridges that usually form in drilling. This insured the punchings dropping through without hindrance. The plate was then reversed again, and the holes enlarged to one size smaller, after which each hole was reamed to size from the back with a broach that had scarcely any taper at all; the bur that had formed on the face in doing this was left there, and the die hardened and tempered without any trouble. The die was then ground absolutely flat on the face and base; the edge was also ground.

Making the Supporting Plate

Supporting plate *C* was made of 40-point carbon open-hearth steel, thoroughly annealed, and was machined so that it rested on the flange in the bolster A^1, and was flush with the bottom of the bolster *A*. This plate was then pushed into the bolster *A* with the die *B* over it, and all screws and dowel-pin holes transferred to it and into the bolster *A*, after which both were removed and doweled together, and the clearance holes for the

punchings spotted by a drill that was running at high speed. The die *B* and the plate *C* were then taken apart, and the clearance holes drilled through *C* the same size as those in the die *B*, and then reamed slightly larger so that each hole was smooth, and both face and base of *C* were slightly countersunk to remove the bur in drilling and reaming.

Making the Punch Block

The punch block *D* was made of cast iron, machined as shown. To it was fastened the punch plate *E*, which was also made of 40-point carbon, open-hearth steel, thoroughly annealed. The center of this plate having been established, the locations of the holes for the punches were then transferred to it through the die, and the holes drilled three sizes smaller than finished size, and the back face countersunk to receive the heads of the punches. This plate *E* was fastened to the punch block *B* by 37 filister-head screws as shown, which necessitated 37 short punches which had to bottom on the screws. This plate was then laid aside temporarily. The stripper shoe *F* was a steel casting, machined to slide nicely over the punch blocks *D* and *E*, and was held in position by eight shoulder screws (not shown), which allowed enough action in stripping.

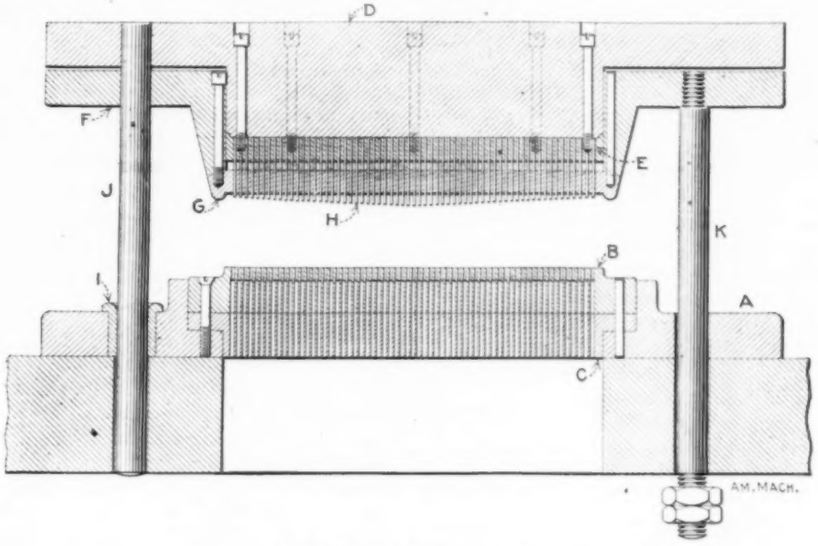


Fig. 2. The Punch and Die

Making the Stripper

The stripper plate *G* was attached to *F* by screws and dowels. The plate *G* was also made of low-carbon open-hearth steel, and machined to fit the nose of the stripper shoe *F*. With the center hole located, the balance of the punch holes were located and spotted through the die *B*. These holes were drilled three sizes less than finished size, and the back countersunk to assist in guiding the punches. The two disks *E* and *G* were then clamped together and the holes enlarged to one size under finished size by drilling them both, after which the cutting die *B* is added, and the holes reamed with a special reamer, which alines all the holes. The stripper plate *G* is then enlarged slightly to a nice sliding fit for the punches.

Making the Punches

The punches *H*, of which there are 2977, are made of piano wire, headed and absolutely straight, and are made of various lengths, so that they will conform to the pitch or shear, which is ¼ inch from the center to the outside edge, which insures easy action in punching, as the punches cut in series. In actual practice better results were obtained by this method than in "staggering" them, namely, making them of uneven lengths and setting them indiscriminately, the punches in each row being of uniform length were readily sharpened, and had the additional feature of being ground at an angle toward the center, the whole surface of the punch did not cut at once, but easily "sheared" the hole through.

Assembling

All the parts were then ready to assemble, and the reinforcing plate *C* and the die *B* were permanently secured to the bolster *A*. All the punches *H* were shoved through the punch plate *E* and through the stripper plate *G*, after which this plate *G* was fastened to the stripper shoe *F* by screws and dowel pins, as shown. This stripper shoe *F* with parts attached was then fastened with special screws to the punch block *D*, the punch plate *E* screwed against its face and the punches *H* entered into the die *B*. All the parts then were bolted together absolutely parallel, and the sliding guide dowel-pin holes were then machined, which was done in this instance on the faceplate of a large engine lathe. These dowels *I*, of which there are four, are made of tool steel, hardened and ground full length, and fitted snugly into punch block *D*, with a nice sliding fit through stripper shoe *F*. The bolster *A* was provided with inserted bronze bushings *J*, with spiral oil groove in each to insure easy sliding. Four stripper bolts *K* were attached, which screwed into the stripper shoe *F*, and had two adjusting jam nuts on each, so that the "pull" in stripping against the press bolster would be parallel.

After the punches were ground with the stripper shoved back against the punch block, they were pushed through into the die, by the slide of the press, and the burs carefully brushed away, the nuts on the stripper bolts adjusted properly, when it was ready for action.

The cutting and stripping were accomplished without any undue strain on the part of the press or working parts of the die, and as many as 300 gross pans were perforated at a time before it was found necessary to grind the die and punches.

Simple Press Tools for an Air Regulator

By J. W. Day

Although we often see descriptions of press tools as they are made in a well equipped tool room, there are many small shops in England where a vise, foot lathe and hand presses are the full shop equipment.

In these small shops the orders for stamping are mostly for small quantities only and very little time or money can be spent upon tools. The following description and cuts are of a very simple piece of work, but serve to illustrate the simplicity of the tools and operations:

Fig. 1, *P* shows an ordinary air regulator for an incandescent gas burner made of 0.025-inch brass. *L M N O P* are the different operations in the manufacture of the shell.

Fig. 2 shows the combined blanking and drawing tool for making the cup *L* in Fig. 1. This tool is made up of a mild-steel bolster plate *A* slightly recessed to take the tool steel, hardened and tempered blanking die *B*, and also carries the tool-steel drawing punch *C* which is also hardened and tempered. The end is slightly tapered and driven tightly home into a taper hole bored in the bolster plate *A*.

The machine-steel clamping ring *D* holds the die in position with three ⅜-inch hexagon-headed screws. This method of holding gives a firm and even grip and obviates the need of drilling and tapping holes in the die itself.

The pressure pad *E* is made of tool steel, hardened and tempered. The pressure pins, plates, spring buffer, bolts and nuts are as usual.

The blanking punch *F* and drawing die are made of tool steel but not hardened. This is left soft to allow the punch to take all the wear and to enable it to be more easily repaired by being peened up and faced off in the lathe.

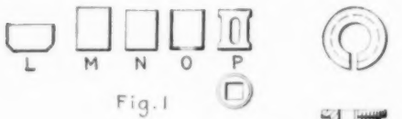


Fig. 1

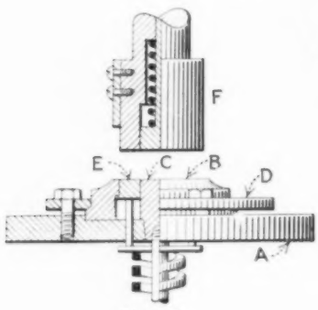


Fig. 2

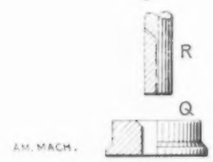


Fig. 3

Fig. 4

Fig. 5

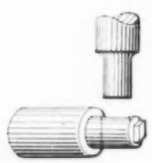


Fig. 6

THE WORK AND THE TOOLS

The ejector pad is shown at *G* and the spring at *H*. The chisel point *J* cuts one side of the scrap, allowing it to be easily stripped from the punch. The redrawing tools are shown in Fig. 3, detail *Q* being the tool-steel, hardened and tempered die, which fits into the recess of the bolster plate *A*, Fig. 2. Detail *R*, Fig. 3, is the redrawing punch made of tool steel, hardened and tempered.

Fig. 4 shows the trimming chuck which is simply a piece of steel bored and split, and then spring tempered. This was held in a self-centering chuck on the lathe and the facing tool fed to a stop.

Fig. 5 shows the tools for piercing the square hole in the bottom of the shell, *S* is a tool-steel hardened and tempered die driven tightly into the same bolster, and *T* the tool-steel hardened and tempered punch.

Fig. 6 shows the tools for piercing the four air slots, which require no explanation; the locating being done from the square hole in the bottom of the shell fitting on a square filed on the front of the die.

The die is used in conjunction with an angle plate. These tools are simple, easily and cheaply made and suitable for use in small hand presses.

The production in the United States of forged iron and steel axles, shafting, etc., during the year 1910 was 319,862 gross tons.

Hobbing Gears with Large Prime Numbers of Teeth

BY GLENN MUFFLY

In gearing up to generate spiral gears and in compounding lathe gears to cut hobs or worms to mesh with gears made in diametrical pitches, it often happens that a large gear with a prime number of teeth is required in order to obtain the greatest accuracy.

Since such gears cannot be cut in the regular way on any type of gear-cutting machine, I set about to devise a method of compounding the change gears on a hobber to accomplish the desired result.

Now, on the hobber used for this work (No. 3 Farwell), the change-gear formula is

$$\frac{20\,a}{3\,T} = \frac{\textit{product of teeth on driving gears}}{\textit{product of teeth on driven gears}},$$

where a = number of threads on the hob and T = the number of teeth to be cut. Obviously, when T is a prime number, this prime factor remains in the result and a change gear with this number of teeth will be required to start with, bringing us back again to the problem of how to cut the first one.

Some time ago, I figured out a formula that enabled us to cut true spiral gears by compounding in the simple change-gear train used for spur gears. Before obtaining this formula, we cut spirals at approximately the desired angle by means of a gear train arranged this way:

$$\frac{20\,a}{3\left(T \pm \dfrac{\textit{feed} \times \textit{tan. angle}}{\textit{circular pitch}}\right)} = \frac{\textit{product of driving gears}}{\textit{product of driven gears}}.$$

In this formula the feed is taken in thousandths per revolution of the blank and characters a and T are the same as above. The $\pm$ sign reads minus when the gear is to be the same hand as the hob and plus when the gear is to be the opposite hand.

The theory of this formula is that you gear the machine for a fraction of a tooth more or less than the number to be cut, and this causes a slight lag or lead in each revolution of the blank. The amount of this lag or lead divided by the amount of vertical feed (that is, hob travel across the face of the blank), gives the tangent of the tooth angle generated.

The error in this approximate formula is doubled when helical gears are used on parallel shafts, and one must be cut right, while the other is left-handed, so it is not satisfactory for general use, but its simplicity makes it available in my method of producing gears with a prime number of teeth.

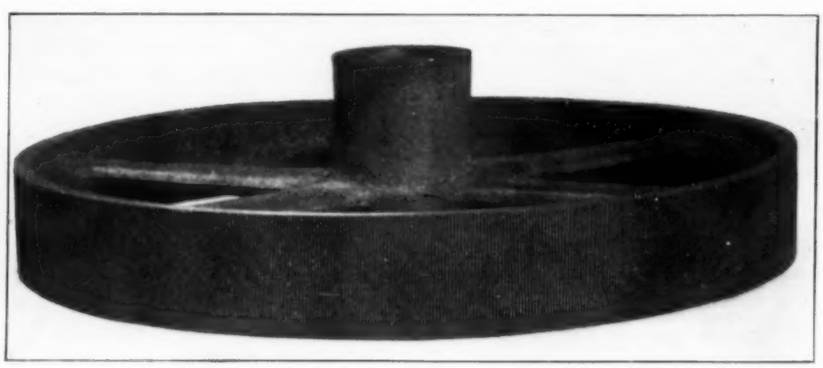
It will be noted that in clearing this formula of the fraction

$$\left(\frac{\textit{Feed} \times \textit{tan. angle}}{\textit{circular pitch}}\right),$$

the quantity T (number of teeth to be cut) is multiplied by the decimal quantity representing the circular pitch and then added to the product of the feed and the tangent of the required angle. Therefore, it makes no difference whether the number of teeth is prime or not, for this quantity is eliminated from the problem.

This suggested the idea of cutting large gears with prime numbers of teeth on a slight spiral and using this spiral gear in the change-gear train to cut a spur gear with the same number of teeth. It is desirable to have the angle as small as possible to reduce end thrust and, in many cases, make it possible to drive the spiral change gear with a narrow-faced spur pinion and save the cost of making a special spiral pinion, which would be used but once. It is not necessary to choose the angle, so the fraction in the denominator of the formula is made as small as is consistent with easy handling of the figures.

The accompanying photograph shows a 48-pitch 877-tooth (prime number) gear, which was cut by this method. This is the original gear with teeth on a slight spiral, and I believe is the first gear ever cut with so large a prime number of teeth.



HOBBING GEARS WITH LARGE PRIME NUMBER OF TEETH

The process of computing a change-gear train to cut the first 877-tooth gear, was as follows for a seven-threaded hob taking the fraction 1/187 as the part of a tooth lag in each revolution of the blank. The quantity 187 is composed of

small factors, which is very desirable, since it will appear on the driving side of the result, where a large gear could not be conveniently used.

Starting with the formula $\frac{20 \times 7}{3 \times 877\frac{1}{187}}$ we clear the quantity 877 1/187 thus:

$$877 \times 187 = 163{,}999$$
$$163{,}999 + 1 = 164{,}000$$
$$877\ 1/187 = \frac{164{,}000}{187}$$

$$\frac{20 \times 7}{3 \times 877\frac{1}{187}} = \frac{20 \times 7}{3 \times \frac{164{,}000}{187}} = \frac{20 \times 7}{\frac{3 \times 164{,}000}{187}}$$

$$= \frac{\frac{20 \times 7}{1}}{\frac{3 \times 164{,}000}{187}} = \frac{20 \times 7 \times 187}{1 \times 3 \times 164{,}000} =$$

$$\frac{2 \cdot 2 \cdot 5 \cdot 7 \cdot 11 \cdot 17}{3 \cdot 2 \cdot 5 \cdot 2 \cdot 5 \cdot 2 \cdot 5 \cdot 2 \cdot 2 \cdot 41} =$$

$$\frac{2 \cdot 2 \cdot 5 \cdot 7 \cdot 11 \cdot 17}{3 \cdot 2 \cdot 5 \cdot 2 \cdot 5 \cdot 2 \cdot 5 \cdot 2 \cdot 2 \cdot 41} =$$

$$\frac{7 \times 11 \times 17}{75 \times 8 \times 41} = \frac{20 \times 77 \times 17 \text{ } \textit{driving gears}}{75 \times 160 \times 41 \text{ } \textit{driven gears}}$$

The circular pitch is secured thus:

$$3.1416 \div 48 = 0.06545 \text{ inch}$$

and our lag per revolution is 1/187 of this, or 0.00035 inch.

Dividing this lag by the feed per revolution, which in this case was 0.13028 inch, we have 0.002686 as the tangent of the tooth angle. Reference to a table of trigonometric functions shows that this represents an angle of only a trifle over 0 degree 9 minutes, which is hardly noticeable on the finished gear.

When other prime numbers are encountered in working out this formula, it is necessary to try a new fraction or subtract it from the number of teeth (making 876 186/187 in this case). A larger number than 187 would reduce the angle still further, but might complicate the factoring of the large number obtained by multiplying into the number of teeth. Having a table of factors for quantities up to 20,000, I chose a number that would give a result ending in 9, which, with 1 added, would make the quantity divisible by 10 and bring it within the range of the table. In this case it just happens that 164,000 factors easily without the aid of a table.

This method enables anyone with a gear-hobbing machine to cut any prime number of teeth desired, and so get much more accurate results in the hobbing of spiral gears.

All methods of computing gear ratios to generate spiral gears are prolific of figures, and when a prime number is encountered, it means going through the process again and trying for another and less accurate result. With all prime numbers of teeth available for change gears, much time may be saved and more accurate spiral gears produced.

This also applies to the computation of change gears to cut hobs with the normal pitch equal to the circular pitch of the spur gear to be cut.

Shop Floors and Materials*

By H. J. Lamborn†

A discussion of the suitability of various types of materials for shop floors.

Some precautions to be taken in buying the flooring.

*Read at the October New York meeting of the American Society of Mechanical Engineers.

†Yale & Towne Manufacturing Company, Stamford, Conn.

After the special purpose requirements are filled, the design of any structure has for its ultimate purpose the assembling of those materials which will longest and most completely resist destruction.

In short, this brings us face to face with the fact that practically all building materials are susceptible to destruction, and therefore a selection of materials best suited to a given structure can be made only after an investigation of the destructive agents for the specific case. Likewise in the premises, we might state that there is no one material that is best suited to fit all cases.

The most active destructive agents commonly at work are: Attrition, due to use and to vibration; fire, water, chemical reactions, and vegetable fungi.

In applying these elements of failure to factory floors, we shall consider the supporting members of the structure as an integral part of the flooring system, since the failure of the supporting members to fulfil their purpose of design would condemn an otherwise satisfactory structure.

The Three Systems of Support

Of the three systems of supports in common use in factory design, timber, steel and reinforced concrete, each has its applications, governed either by cost or fitness. Timber in mill construction and reinforced concrete both have good qualities of resistance to destruction by fire, and while in this respect concrete must take precedence, yet there is much to favor mill construction. Steel supporting work has failed so frequently in cases of fire that insurance engineering of the best character recommends its use in hazardous places only when it is fireproofed.

Steel framework will transmit vibration much more readily than either timber or reinforced concrete, and is therefore not well suited for structures subject to shock from unbalanced machines or pure shock operations.

In the presence of moisture, reinforced concrete is the best material, with timber second, and unprotected steel the least desirable.

Active chemical fumes are best withstood by timber in the majority of structures, with reinforced concrete and steel about equal valuable. Acid-resisting coatings are not always effective, and the design in such cases should provide for easy replacement of structural members liable to attack.

Fungi and dry rot are to be considered only in the cases of timber, and when there is a good circulation of fresh air, little is to be feared from these causes.

The Supporting Floor

Coming now to the supporting floor proper, there are practically but two ma-

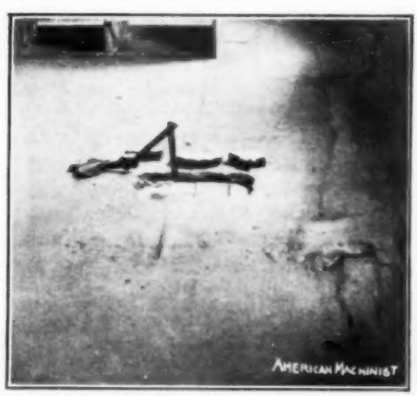


Fig. 1. Asphalt Covering Floor Laid on Wooden Supporting Floor

Fig. 2. Another Example of Asphalt Covering Floor

FIG. 3. BRICK AND IRON-PLATE FOUNDRY FLOORING

FIG. 4. MAPLE WEARING FLOOR REPLACEMENT AT ENTRANCE

FIG. 5. A YELLOW-PINE WEARING FLOOR 31 YEARS OLD

terials in use in factory floors, timber and reinforced concrete, upon which additional floor covering is laid, if any is required. In the timber supporting floors, there are two methods of design in use. First, planks of a width greater than the depth are either rabbeted on both edges and a suitable spline inserted, or else a tongued-and-grooved plank is used. Secondly, square-edge planks of a depth equal to or greater than the width are spiked together. Of these two methods

FIG. 6. HEAVY MILL CONSTRUCTION, SPIKED PLANK SUPPORTING FLOOR

of plank flooring, the latter has several advantages. First, it is stiffer against both deflection and vibration, as the mass is intimately tied together. Secondly, warping of the plank, such as occurs in wide-faced and heart timber, does not affect the floor level, and consequently machine levels. Thirdly, it is little, if any, more expensive to lay than a close-fitting splined or tongued-and-grooved flooring. Reinforced concrete as a base or foundation-flooring material has many advantages, of which the first and most important is its fire-resisting qualities. But in the case of factories using much machinery, its freedom from vibration under usual conditions adds largely to the life of machinery, and consequently reduces the cost of replacements and repairs.

The difference in weight of concrete and wood, being about 140 pounds, against a probable average of 50 pounds per cubic foot, adds about three times the mass for equal thickness of floors, and consequently an increased inertia for equal vibrations. Reinforced-concrete supporting floors, for equal spans and strength, are thicker than wooden floors, and consequently the mass is still more increased.

The question of freedom from vibration, other things being equal, in manufactories where duplication of parts is required, becomes a highly important factor in the cost of production. But quite equal in importance with stiffness against vibration, is stiffness against deflection for the support of machinery whose proper functioning requires that they be level or within a given plane.

The elements of designing against deflection to prevent cracking of plaster are well understood, but in factory flooring deflection is seldom considered, or the assumed live load is supposed to cover the case. With modern speeds, however, increased machine weights and duplicate manufacture, deflection in each case is worthy of fuller investigation.

THE INTERMEDIATE FLOOR

Where a top or wearing floor covering is used, it is usual to add an intermediate flooring of thickness varying with the material of the supporting floor. In the case of a timber base, the intermediate floor is usually of boards, at right angles to the direction of the supporting plank, and thus adds to the stiffness. With a reinforced-concrete base and a wooden wearing floor, the intermediate flooring of boards or plank is laid on screeds which have been bedded in tar concrete, or in cinder concrete, the purpose of this intermediate flooring being to make a ready fastening for machinery or a base for close nailing to the top flooring. Where waterproofing is applied, it should be placed under the intermediate flooring. All screeds should be chemically treated, or else coated, and laid in a bituminous envelop to preserve them against dry rot.

THE WEARING SURFACE

In factory floors the wearing surfaces are of wood, concrete, iron, brick, asphalt or clay. The woods usually employed are: Southern pine, either common sawed, rift or comb-dressed, maple, beech, birch, oak, hemlock and spruce. Of these materials the most common are Southern pine and maple. Maple of a factory grade is being extensively used, and has gained favor, due to its wearing much move evenly and smoothly, its good resistance to wear and its favorable price.

Beech and birch are not used generally, but frequently come mixed in, in small

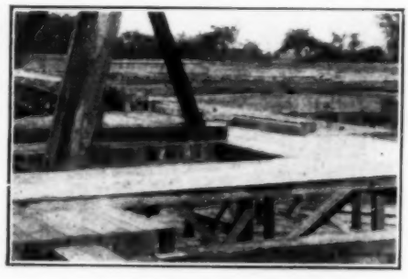


FIG. 7. HEAVY MILL CONSTRUCTION IN COURSE OF ERECTION

quantities with maple. The oldest flooring surface in modern factories is Southern pine, common cut. This material has usually worn well, when the trees from which it was sawed have not been tapped to death, and there was the required density to season well. The common cut has the disadvantage of breaking up in splinters when worn, and in this condition it is dangerous.

The rift cut, or comb-dressed southern-pine flooring, overcomes the objection of splintering and has great wearing qualities. Its cost is somewhat greater than maple of the factory grade.

Oak has been used as a wearing floor,

and at the present time there is being produced a factory grade, which, while costing more than the other wooden floor coverings, probably has greater resistance to wear.

Hemlock and spruce are used only in the cheaper grades of flooring, and are at best but poor substitutes for the harder and closer-grained woods.

Laying the Wooden Flooring

The face of the finishing flooring should not exceed 3 to 4 inches; and it should be planed with a hollow back and square edge, with or without a tongue and groove on the ends.

The square edge facilitates repairs, gives the greatest floor-covering surface for the board feet of flooring purchased, and is less expensive to lay. Face nailing should be used except in special cases, since blind nailing interferes with ready repairs.

Since the wear of floor surfaces comes mostly from travel and trucking, the floor boards should be laid in the direction of maximum travel, since a cross travel wears the boards much more quickly and unevenly. Uneven wearing is very detrimental to low production costs, where the finished product is of a perishable nature and cannot be subjected to rough handling.

Fig. 8. Yellow-pine Wearing Floor 30 Years Old

There are but few objections to a wooden wearing surface and from the standpoint of health, it offers perhaps the least objections from dust and the abstraction of bodily heat.

All wooden top flooring should be laid up with floor jacks, since there is not only a decided gain in the quality of the laid surface, but the same can be put down more quickly, and with less likelihood of nails splitting the boards. The nails should be cut nails and best of all tempered steel cut nails all well set after driving.

In the presence of much heat, large quantities of moisture and chemicals in bulk, wooden floor coverings should not be used.

Concrete Floor Coverings

Concrete floor coverings have been seeking to gain entrance as a factory floor, but there seems to be many valid objections to their use, in the majority of cases. When first laid and well troweled, concrete makes a very atractive flooring, but as soon as use and wear begin, it becomes difficult of upkeep and repair. The wearing away of the first troweled surface marks the beginning of much more rapid wear and with a crack or joint once started, there is soon developed a bad hole under shop trucking and the handling of heavy materials.

Unquestionably there is a much more rapid abstraction of bodily heat through the feet on a concrete-floor surface with its attendant feeling of bodily discomfort. Where the character of the work produced is of a small or intricate nature and nervous rather than phlegmatic dispositions are required for rapid and economical manufacture, these conscious feelings of discomfort greatly decrease production.

In the presence of intense heat and free acids, a concrete surface is soon destroyed and, because of the difficulty of repair, becomes a burden of expense. By intense heat is meant such a condition as would arise where hot metal is spilled. The disintegration is here due to the probable presence of moisture and the kicking off of small particles from the sudden formation of steam.

In places where there is not much wear, as in certain classes of store rooms, and where there is a liability of much moisture, as in wash rooms, concrete floor coverings are most acceptable.

As a foundation material, concrete in its several forms will probably be the most universally used material of building construction, but as a finishing material there is much yet to be developed in its methods of handling and treatment to place it in the front rank.

Other Floor Coverings

Cast-iron plates are excellent coverings for the runways of foundry floors and in places where hot metals are liable to be spilled. But in their use, care should be taken to place them where the character of wear will not cause them to become smooth.

Brick affords a good covering for floors where there is heavy trucking, much moisture, intense heat, or scouring wear.

In the foundry, brick is finding more and more favor, one of its great advantages being easy and unit replacement.

Asphalt coverings are susceptible of wide application in factory flooring, principally because of their water and acid resisting qualities, and partly because of their flexibility of installation when applied by trained workmen. These floors are likewise good fire retardants, and are largely used where the nature of the material is inflammable.

The asphalt floors are found in plating rooms, toilet rooms, acid dip rooms, die houses, bleacheries, lacquer rooms and similar locations. When applied over wooden floors they are first underlaid with a covering of building paper and the hot mastic properly tempered, poured on top. There have been some criticisms against asphalt coatings, wrinkling after being laid, but this difficulty can be overcome by properly tempering the mixture of mastic and sand.

There have been brought out several composition floor coverings, and undoubtedly the most extensive comparative study of actual wearing qualities is now being conducted by the New York Central railroad, at its Grand Central depot. The records of these tests would make a most important addition to our knowledge of this class of floor coverings. There has been a recent replacement in part, of one of these composition coverings at the New York Hippodrome where slate treads were inserted in the place of composition treads on the stairs.

A most important part of the factory floor covering that is subjected to concentrated wear and which is worthy of careful study in design, is the stairs. Here there is not only the problem of wear, but the constant danger of personal injury if the materials of construction are not well selected and applied. Arrangements under all circumstances should be made for easy repairs to the treads, no matter what the material of construction.

When made of timber, the stair foundations should be more massive than the requirements of mere strength would dictate, in order to provide against destruction by fire. Over this foundation a wearing tread should be laid. Oak, maple and rift-sawed yellow pine make excellent coverings.

The reinforced-concrete stair foundation is most attractive from the standpoint of fire protection, and whenever possible should be given serious consideration. Recent happenings have shown that in cases of disaster, factory stairs may easily become the most important feature of the structure. Where concrete is used, a wearing tread should be inserted and so bedded in the concrete that the anchorage remains as an integral part of the concrete base and the

wearing surface easy of attachment to the anchorage. Cast-iron plates filled with lead or carborundum composition and known as safety treads are among the best wearing coverings.

Structural-steel foundations with cast-iron treads or full cast-iron stair construction is used in some locations with satisfaction. Safety treads should be used on stairs of this character, not so much for their ease of replacement when worn, as to preclude the cast iron's wearing smooth and being a possible cause of injury to the users.

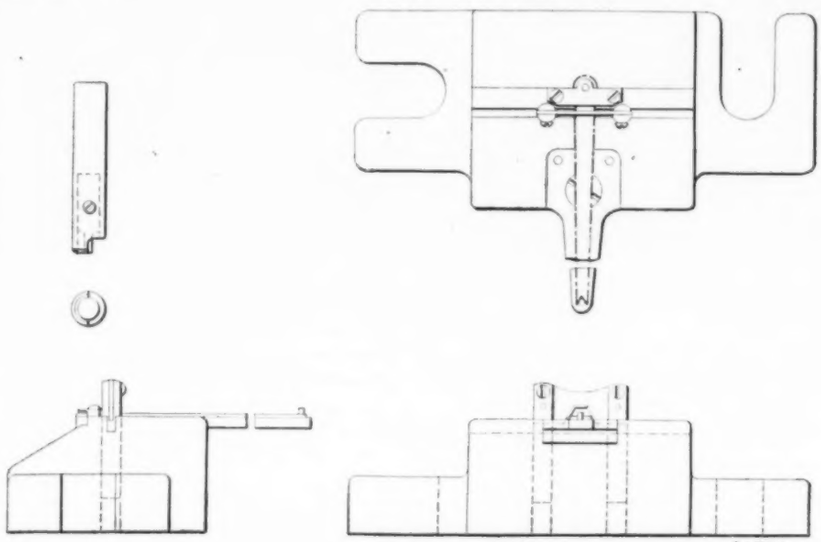
Rounding and Piercing the End of a Thin Metal Strip

By M. B. Hall

The feature of the tool shown in the accompanying figure, which I believe is a new feature, is the method of centralizing each strip regardless of how it may vary in width, within an established limit, from the preceding one.

This centralizing or locating device is so made that the V-shaped cut is properly alined with the die; the die bed is slotted as shown in the profile view, thus allowing a wide margin of action. The runners or posts have a free fit with the die bed in order that the device can be raised easily and permitted to drop under its own weight.

The metal plate in position is shown by heavy dot-and-dash lines in the plan and heavy, solid lines in the profile and elevation, from which the idea will be clearly understood.



PUNCH AND DIE

ELBOWS

	Center to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	3¾	4½	⅜	3¼	4	½
1½″	4	5	⅜	3½	4	½
2″	4½	6	⅜	4¾	4	¾
2½″	5	7	⅜	5½	4	¾
3″	5½	7½	⅜	6	4	¾
3½″	6	8½	⅜	7	4	¾
4″	6½	9	⅜	7½	8	¾
4½″	7	9¼	⅜	7¾	8	¾
5″	7½	10	⅜	8½	8	¾
6″	8	11	1	9½	8	¾
7″	8½	12½	1⅛	10½	8	⅞
8″	9	13½	1¼	11½	8	⅞
9″	10	15	1⅜	13¼	12	⅞
10″	11	16	1⅜	14¼	12	1
12″	12	19	1½	17	12	1
14″	14	21	1⅝	18¾	12	1¼
15″	14½	22½	1⅝	20	16	1¼
16″	15	23½	1⅝	21¼	16	1¼
18″	16½	25	1⅞	22¾	16	1¼
20″	18	27½	1⅞	25	20	1¼
22″	20	29½	1⅞	27¼	20	1¼
24″	22	32	1¾	29½	20	1¼

45-DEG. ELBOWS

	Center to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	2	4½	⅜	3¼	4	½
1½″	2¼	5	⅜	3½	4	½
2″	2½	6	⅜	4¾	4	¾
2½″	2¾	7	⅜	5½	4	¾
3″	3	7½	⅜	6	4	¾
3½″	3½	8½	⅜	7	4	¾
4″	4	9	⅜	7½	8	¾
4½″	4¼	9¼	⅜	7¾	8	¾
5″	4½	10	⅜	8½	8	¾
6″	5	11	1	9½	8	¾
7″	5½	12½	1⅛	10½	8	⅞
8″	6	13½	1¼	11½	8	⅞
9″	6½	15	1⅜	13¼	12	⅞
10″	7	16	1⅜	14¼	12	1
12″	7½	19	1½	17	12	1
14″	7½	21	1⅝	18¾	12	1¼
15″	8	22½	1⅝	20	16	1¼
16″	8	23½	1⅝	21¼	16	1¼
18″	8½	25	1⅞	22¾	16	1¼
20″	9½	27½	1⅞	25	20	1¼
22″	10	29½	1⅞	27¼	20	1¼
24″	11	32	1¾	29½	20	1¼

LATERALS OR Y BRANCHES

	Center to Face	Face to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	6½	8½	4½	⅜	3¼	4	½
1½″	6¾	9½	5	⅜	3½	4	½
2″	8	10½	6	⅜	4¾	4	¾
2½″	9½	12	7	⅜	5½	4	¾
3″	10	13	7½	⅜	6	4	¾
3½″	11½	14½	8½	⅜	7	4	¾
4″	12	15	9	⅜	7½	8	¾
4½″	12½	15¼	9¼	⅜	7¾	8	¾
5″	13½	17	10	⅜	8½	8	¾
6″	14½	18	11	1	9½	8	¾
7″	16½	20½	12½	1⅛	10½	8	⅞
8″	17½	22	13½	1¼	11½	8	⅞
9″	19½	24	15	1⅜	13¼	12	⅞
10″	20½	25½	16	1⅜	14¼	12	1
12″	24½	30	19	1½	17	12	1
14″	27	33	21	1⅝	18¾	12	1¼
15″	28½	34½	22½	1⅝	20	16	1¼
16″	30	36½	23½	1⅝	21¼	16	1¼
18″	32	39	25	1⅞	22¾	16	1¼
20″	35	43	27½	1⅞	25	20	1¼
22″	37½	46	29½	1⅞	27¼	20	1¼
24″	40½	49½	32	1¾	29½	20	1¼

LONG-TURN ELBOWS

	Center to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	6	4½	⅜	3¼	4	½
1½″	6½	5	⅜	3½	4	½
2″	7	6	⅜	4¾	4	¾
2½″	7½	7	⅜	5½	4	¾
3″	8	7½	⅜	6	4	¾
3½″	9	8½	⅜	7	4	¾
4″	10	9	⅜	7½	8	¾
4½″	11	9¼	⅜	7¾	8	¾
5″	12	10	⅜	8½	8	¾
6″	13	11	1	9½	8	¾
7″	14½	12½	1⅛	10½	8	⅞
8″	16	13½	1¼	11½	8	⅞
9″	18	15	1⅜	13¼	12	⅞
10″	20	16	1⅜	14¼	12	1
12″	22	19	1½	17	12	1
14″	24	21	1⅝	18¾	12	1¼
15″	26	22½	1⅝	20	16	1¼
16″	28	23½	1⅝	21¼	16	1¼
18″	30	25	1⅞	22¾	16	1¼
20″	32	27½	1⅞	25	20	1¼
22″	31	29½	1⅞	27¼	20	1¼
24″	36	32	1¾	29½	20	1¼

TEES AND CROSSES

	Center to Face	Face to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	3¾	7½	4½	⅜	3¼	4	½
1½″	4	8	5	⅜	3½	4	½
2″	4½	9	6	⅜	4¾	4	¾
2½″	5	10	7	⅜	5½	4	¾
3″	5½	11	7½	⅜	6	4	¾
3½″	6	12	8½	⅜	7	4	¾
4″	6½	13	9	⅜	7½	8	¾
4½″	7	14	9¼	⅜	7¾	8	¾
5″	7½	15	10	⅜	8½	8	¾
6″	8	16	11	1	9½	8	¾
7″	8½	17	12½	1⅛	10½	8	⅞
8″	9	18	13½	1¼	11½	8	⅞
9″	10	20	15	1⅜	13¼	12	⅞
10″	11	22	16	1⅜	14¼	12	1
12″	12	24	19	1½	17	12	1
14″	14	28	21	1⅝	18¾	12	1¼
15″	14½	29	22½	1⅝	20	16	1¼
16″	15	30	23½	1⅝	21¼	16	1¼
18″	16½	33	25	1⅞	22¾	16	1¼
20″	18	36	27½	1⅞	25	20	1¼
22″	20	40	29½	1⅞	27¼	20	1¼
24″	22	44	32	1¾	29½	20	1¼

STEEL FLANGES AND FITTINGS ARE RECOMMENDED FOR SUPERHEATED STEAM

Standard or extra heavy reducing elbows carry same dimensions center to face as regular elbows of largest straight size.

Standard or extra heavy tees, crosses, laterals, or Y branches, reducing on run or outlets, carry same dimensions face to face and center to face as largest straight size.

If flanged fittings for lower working pressure than 125 pounds are made they shall conform in all dimensions except thickness of shell to this standard, and guaranteed working pressure must be cast on each fitting.

Where long-turn fittings are specified it has reference only to elbows, which are made in two dimensions, to be known as "elbows" and "long-turn elbows," the latter being used only when so specified.

All standard weight fittings must be guaranteed for 125 pounds and extra heavy fittings for 250 pounds working pressure, and each fitting must have some mark cast on it indicating the maker and guaranteed working steam pressure.

Standard weight fittings and flanges to be plain faced.

Bolts to be ⅛-inch smaller in diameter than bolt holes.

Size of all fittings scheduled indicates inside diameter of ports.

For O. D. pipe use corresponding sizes of I. D. fittings.

These dimensions, both standard and extra heavy, refer to either cast-iron or cast-steel fittings and rolled-steel flanges.

DIMENSIONS OF STANDARD WEIGHT FLANGED FITTINGS ADOPTED MARCH 13, 1911, BY A COMMITTEE OF THE NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS AND THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

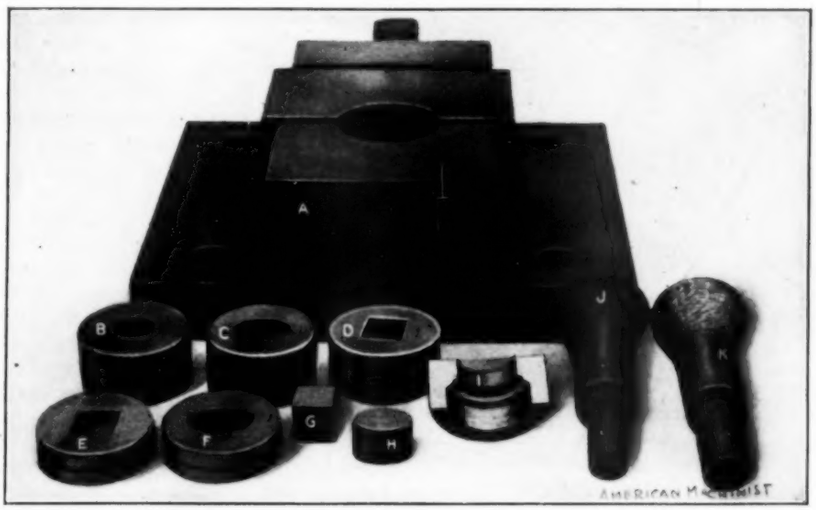
Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Economical and Rapid Method of Die Making

Modern railway-track equipment has undergone many changes in recent years, in order to keep pace with the ponderous locomotives and rolling stock. Tie plates are being generally adopted and fins or joint plates are being made much heavier and longer, with a vertical flange attached immediately under the joint in order to reduce to a minimum the tendency to sag at this point. To assist in securing increased rigidity, to prevent spring and bending, the railways are also demanding harder material; so hard in many cases that it becomes necessary to shear or punch them hot, and to meet these severe demands, improvements in efficiency and economy in the cost of tools and processes would seem to follow naturally, and our method of die production is about as simple and rapid as could be desired for our class of work.



ECONOMICAL AND RAPID METHOD OF DIE MAKING

The dies we use are turned, drilled, counterbored to within about ¼ inch of the face and cut off the bar at one setting in the turret lathe, the drilled holes in the faces of the dies for elliptical or square holes, being made slightly smaller than the shortest diameter of the finished hole.

After leaving the turret lathe, the dies are placed in the holder *A*, shown in the accompanying halftone, a guide the proper size placed on top and a hardened plug forced through. The use of a guide insures the hole being punched in the center of the die. We allow about $\frac{1}{32}$ inch clearance between our punches and dies, or $\frac{1}{64}$ inch all around and so these hardened plugs are made that much larger than the punches to be used in the die.

In the halftone *B* is a die just as it comes from the turret lathe; *C* is a finished elliptical die; *D* a finished square die; *E* a square guide; *F* an elliptical guide; *G* a square plug; *H* an elliptical plug; *I* an elliptical die sawed in two to show how it is made; *J* and *K* plungers used to force the plugs through the dies.

J. J. NEWBAKER.

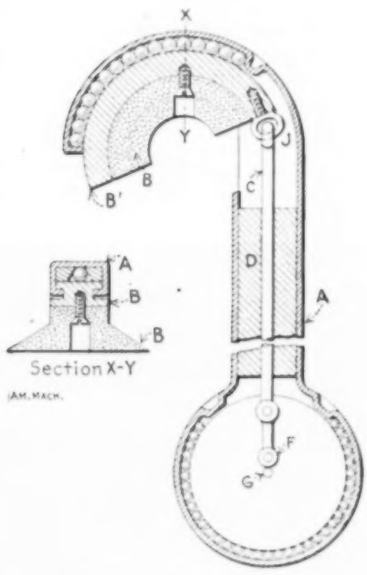
Steelton, Penn.

Tool for Finishing Tubing

The man who works in a bicycle factory knows what difficulties wait on the filing and snagging of the frames. The filing work on bicycle frames is rendered still harder by the very hard crusts of borax formed on dip-brazed places.

The practical consequence of these difficulties is that the work in question has been inadequately coped with, even to the extent sometimes that the filing room dictates the productive capacity of the factory and often it has occurred that many plants—some constantly, some periodically—could not exert their full capacities because the file room did not deliver enough product.

This has led to the design of a new tool, shown in the accompanying cut. A requisite in this tool was, that it should cut out the extreme physical exertion of filing. It has also increased production.



TOOL FOR FINISHING TUBING

The illustration shows the principle of the tool. It consists of stamped-out sheet-metal housing *A*, which terminates at one end in a hook like a walking stick and at the other end broadens into a box. In this box end there turns at *G*, on ball bearings, a disk which actuates an eccentric with an appurtenant push rod *F*. As the disk is turned by a thin, flexible shaft, it moves this eccentric, which produces an extremely rapid reciprocating motion of the rod *C*, which slides snugly in the part *D*. At its other end this rod hooks an eye *J*, which must be crosswise oblong in order to accommodate the hook to its arc movements as it follows the piece *B*, which is attached to it.

Through the up-and-down motion of the rod *C*, the carborundum segment *B* is given a reciprocating oscillation, or arc movement, which, because of its rapidity will perform an unexpectedly great amount of work.

The workman simply hooks the tool over the tubing and pulls on it moderately, gradually turning it so that it finishes the entire periphery of the tube.

The construction may be improved by setting the piece of carborundum, not directly in the hook-shaped part of the tool, but substituting a steel piece *B'* running on a row of balls. The carborundum is then attached to the steel piece by means of a few screws, which arrangement furthermore possesses the advantage that the carborundum can easily and quickly be exchanged for another piece suitable to the diameter of the work.

The swallowtail-shaped projections of the carborundum shown in the section were intruded to facilitate working—for example, the corners of a bicycle frame—especially at the places where the tubes join the treadle-bearing housing and from acute angles.

WALTER BAETZ.

Heinrichs, Germany.

Cutting a Keyseat in a Large Shaft

The halftone illustrates the method used to cut a keyseat in a large shaft after it had been shipped to the place of erection, which was 20 miles from the nearest machine shop.

A shaper having a 16-inch stroke was hauled from the shop, the vise and table removed and the end of the shaft bolted directly against the crossguides as shown.

The keyseat, 1x2x16 inches, was laid out in the usual manner and clearance holes for the cutting tool drilled with a ratchet, then when everything was ready the cement mixer nearby, was shut down and its engine belted to the shaper, the keyseat being finished accurately and in good time.

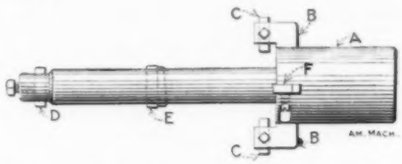
As there was originally no cross feed for the tool, we made the attachment shown in Fig. 2 for this purpose.

Brookline, Mass. EDWARD HURST.

Machining Flywheel Hubs

In the accompanying cut is shown a tool we use in machining the hub and bore of flywheels for 3-horsepower gasolene engines turned out in considerable quantities. The bore of the wheel is 1¼x2⅞ inches deep. The outside of one end of each hub is turned down to 2 inches diameter for a distance of ⅜ inch to receive a thin sleeve that forms part of the timer, and that also acts as a protection against flying grease from the bearing.

The turning of the hub and rough and semi-finish boring formerly required several operations and tool changes, but with the tool shown the work is done in three operations, with but three changes of tools.



TOOL FOR MACHINING FLYWHEEL HUBS

The large end *A* of the tool is a snug fit in the turret of the single-head Colburn mill. The two tool holders *B* are ¾x⅞ inch and were brazed on, being held during the brazing process by a ⅜-inch stud passing through them and into the shank. The brazing was done in an ordinary gasolene brazer, and to facilitate the heating of the comparatively large piece without unduly heating the small pieces, the shank was bored out, leaving the walls ⅝ inch thick, after which the end was plugged to carry a center for finish turning after brazing.

The two cutters *C* for turning the hub, are ⅜-inch self-hardening steel, made a good fit in the square holes, and setscrews hold them in place, the holes being offset to bring the cutting faces radial.

The scale is first removed from the end of the hub with a roughing tool in one of the turret holes; the turret is then moved, bringing the combination tool into place. Cutter *D* removes ⅛ inch of the ¼ inch of stock, leaving ⅛ inch less 0.008 inch for the semi-finish cutter *E*. Cutter *D* passes clear of the bore before second cutter *E* engages, thus permitting it to true up any irregularities left by the first. After the first cutter passes through the work the turning tools *C* turn down the outside of the hub and cutter *F* inserted in the shank, finishes the end of hub, the bore being finished with a reamer.

The limit of variation in turning the outside of the hubs is quite large, 0.005 or 0.008 inch being permissible, as the sleeves are thin steel and are shrunk on; neither do the corners have to be sharp and square.

Fairmont, Minn. GEORGE WILSON.

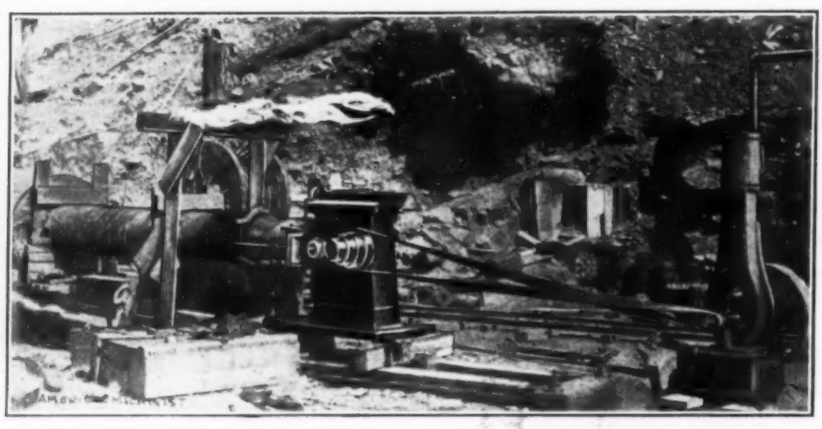


FIG. 1. CUTTING A KEYSEAT IN A LARGE SHAFT

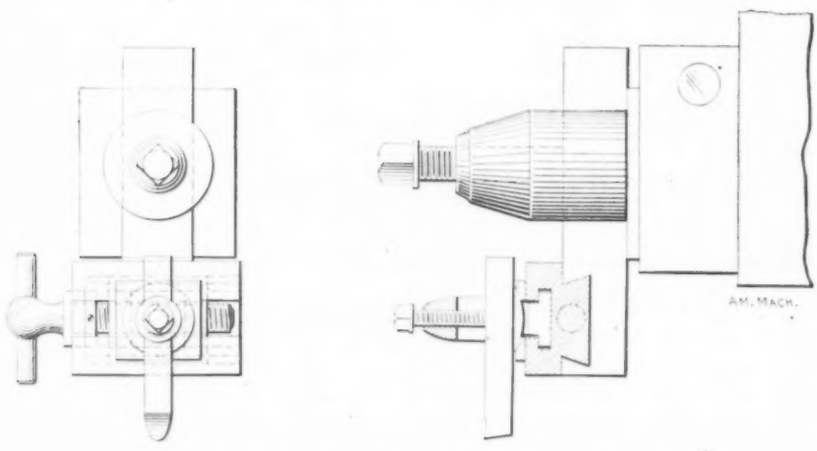


FIG. 2. CROSS-FEED TOOL FOR CUTTING LARGE KEYWAY

The mechanical designer is reaching out into new fields these days and one of the latest efforts should be of service to every community. This is known as the "precision dead beat recorder" and it would seem as though a few of these installed in prominent places in every city should be of incalcuable value. Probably some of our friends who have been victimized by the recent steel-selling schemes would be ready to purchase at once.

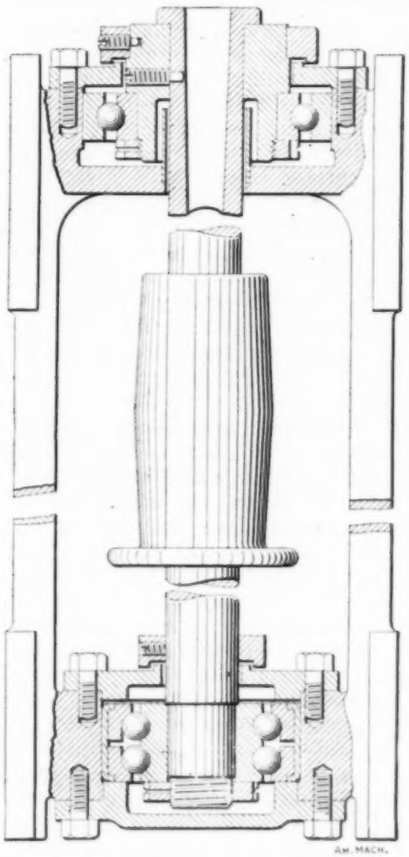
Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Bearings in Woodworking Machinery

It is certainly a source of much gratification to observe the progress being made in the application of ball bearings to places that have been productive of much dissatisfaction and trouble to designers and operators of various kinds of machinery. On page 321, appears an article under the above subject that calls for hearty commendation. To anyone familiar with ball bearings and their correct mounting, the various applications will appear as old friends in new company.

While it is not so stated, it is assumed that each of these arrangements have been in successful use for some time and



MOUNTING FOR VERTICAL SHAPER SPINDLE

have given no trouble. The application as shown in Fig. 8, however, appears to be open to a slight criticism. On the bottom end of the spindle are shown two radial-type ball bearings, the upper one taking the radial load and the lower the thrust caused by the weight of the spindle and extraneous forces. Doubtless this thrust is well within the given capacity of the bearing in question, yet the writer has every reason to regard such conditions with suspicion. In every case where the radial type bearing has been subjected to thrust continuously in one direction, it has been my experience that a groove is quickly worn in the races. This, of course, can result only in the ultimate destruction of the bearing, and an expensive repair to the machine.

The arrangement shown in the accompanying figure will eliminate all risk, however remote, from this source. It will be seen that the mounting is identical with that shown in the original article except that a combination radial and thrust bearing is shown on the lower end of spindle. This type of bearing has been used with uniform success in places where a radial and thrust bearing is required and will develop a much greater thrust capacity than the radial bearing. The cost is approximately the same as the larger radial bearing, thus saving the price of the smaller bearing. A saving in machine work is also effected as but one bore and fit in housing is required and the collar for the thrust bearing is eliminated.

G. W. SMITH.

Wilkinsburg, Penn.

Roll Grinding—Old and New Methods

Mr. Conradson at page 559 makes the statement that there has been no substantial improvement in design or in detail in the grinding lathe during the past forty years.

Modern heavy grinding machines for grinding tin-plate rolls weighing up to and over 25,000 pounds, although they have the same conveniences as the small modern grinding machine for quick and accurate production, are not in the same class with the light machines built years ago.

These modern roll grinders are capable of removing chilled iron at the rate of more than two cubic inches per minute. Mr. Conradson states that he produced chilled-iron rolls from the J. Morton Poole grinding lathe, using a wide feed, large water supply, wide face wheels, etc. Will he kindly tell us how much metal they removed per minute?

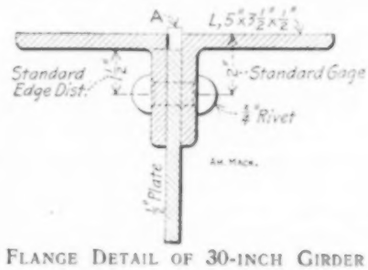
J. H. HOLLINGER.

Waynesboro, Penn.

Special Miller for Structural Shapes

Referring to the article on the above subject published on page 493, while foreign structural practice may require special tools for finishing the web plates flush with flange angles, American practice does not.

A flange detail is shown here for a 30-inch plate girder, as specified in Carnegie Steel Company's handbook. Instead of the web plate projecting outside of



FLANGE DETAIL OF 30-INCH GIRDER

the flange angles, the edge distance (from center of rivet holes to edge of plate) is made less than the distance from the center of rivet holes to the heel of the angle.

In the sketch, all dimensions are Carnegie Steel Company standard for this particular size of girder. Other sizes are similarly arranged.

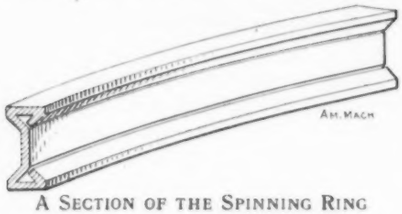
Newburgh, N. Y. J. K. MCINTYRE.

Production in Textile Machinery

I was greatly interested in the article by W. H. Booth on the above subject, page 216. His remarks on the standardizing of the sizes of bolts used for textile machinery are certainly to the point. There are, however, many other features in connection with textile machinery that might be standardized with advantage to the textile manufacturer, the machinist and the toolmaker. These can be dealt with only when, as Mr. Booth states, we know more of the shop operations and methods of the textile machinist.

It must not be understood, however, that the textile machinists are behind the times. Specially designed tools are to be found in almost all textile machinist works. It is in connection with the va-

rious accessories to textile machinery that most ingenuity is displayed. The spindle and the ring accessories are examples. Take the rings mentioned by Mr. Booth. Thousands of these are required. In many



A SECTION OF THE SPINNING RING

cases these rings are made from steel blanks which are turned up and polished so as to give a perfectly smooth surface. One of the finest rings I ever saw was a stamping. A section of this ring is shown in the accompanying illustration and it will be seen that it involves no simple operation. The problem of stamping these rings required a large amount of study and experiment. The class of metal to be used was a matter that proved rather difficult owing to the sharp bends in the stamping. Then again the ring had to be perfectly concentric and there was to be positively no part likely to accumulate dust and "ply." Fortunately too the makers hit upon a steel that polished up like a plated article and this appearance was an additional attraction to the mill man.

Another accessory in connection with ring spinning frames that is demanding a fair amount of attention is the "lappet" or thread guide. These are mainly stampings and it is the boast of one firm alone that they have supplied over four millions of such accessories. These offer interesting problems to the press toolmakers but they are only a few of many.

In connection with weaving machinery it is important to note that a loom requires at least one of every item used in its construction and in some cases two or three of a similar piece are necessary. Bolts for looms might easily be standardized for automatic production, as might also cross and top rods, etc. This class of machine offers a fair field for the tool maker who is prepared to study the matter but as has been previously pointed out textile machinists are not altogether unaware of the economical advantages to be obtained by the use of uptodate tools.

J. E. WILLIAMS.

Manchester, England.

The Suggestion System

Personal experience and opinions from various workmen only strengthen my convictions that this feature of trade development can be made to show on the right side of the ledger for both employer and employee if properly handled and some of the drawbacks eliminated.

Briefly, some of the principal drawbacks that have come under my observation are as follows:

A suggestion that may possess special merit is lost in transmission, only to reappear some time later to the credit of someone a little higher up than the original suggestor.

A suggestion or idea may seem trivial or out of place, but if proffered and accepted in the proper spirit, may prove a starter or runner up for the solution of some perplexing problems or situation, or may result even in the complete revolution of the subject to which it relates, if the fear of censure or ridicule were removed.

Foremen have been discharged or reduced to make room for one of their men who has made a good suggestion, although that may be as far as that man can go; again, foremen have made it unpleasant for, or even discharged a man who has made a good suggestion, in fear of the above result.

There is no incentive or adequate reward for general suggestions. An employee of one of the largest firms in New York suggested a device for reducing the cost of labor and insuring the accuracy of a certain operation in the factory; his suggestion was accepted and used. He received $3 for his idea; the firm saved several thousand dollars annually by using it. If he had other ideas he took them West with him. Pay for what you get, then see that you get what you pay for, and that credit is given to whom credit is due.

It is obvious that the original recipient of suggestions should be an official as high up in the organization as possible, who should keep the original on file and refer a copy of the subject matter to the proper department for consideration. A report on the suggestion should be returned to the original recipient, and such action as the report calls for taken by him, after noting the report on the original suggestion blank.

In this way the value of the suggestion blanks could be checked up at a moment's notice, and false claims of the present systems entirely avoided.

In suggesting a monthly award, amounting to $120 a year, it is understood that this amount may be increased if desired, but an organization that cannot produce $120 worth of original ideas a year needs a shop doctor, quick.

INSTRUCTION CARD

1. Suggestions for the improvement of any part of the operative system of the factory or office, new or improved methods, machinery or devices for reducing cost or increasing output in any department or ideas that will add to the safety, welfare or convenience of the employees, are solicited and will be paid for in cash, if used.

2. The blanks are for the use of employees of this firm only, and any abuse or misuse of the same will result in the discharge of the party or parties so offending.

3. Carefully avoid suggestions prompted by or displaying personal likes or dislikes, as indulgence in this respect will be deemed sufficient cause for discharge.

4. Direct all suggestions to John Doe, and place them in suggestion box.

Use but one blank for each suggestion, should more space be necessary, use plain paper the same size as blank and join sheets with tape or fasteners.

5. Do not sign your name to blank; date blank and voucher the same and keep voucher till further notice.

6. Should your suggestion be accepted, the number will be called for on bulletin board, when you will sign voucher and direct it to John Doe.

7. In addition to all other awards, a monthly award of $10 will be given to the party offering the best suggestion during the month, whether the suggestion is used or not.

8. The award will be made on the points of (1) value to firm, (2) the sincerity a suggestion may show on the part of the suggestor.

Brooklyn, N. Y. G. T. HOUGHTON.

Leveling Lathe Beds

Mr. Le Blond's explanation of methods used by manufacturers in leveling lathe beds is interesting, not alone in what it tells, but in its suggesting again the necessity of some system, some generally understood way of expressing what a level indicates.

Occasionally we see variations indicated by the use of a level expressed in degrees and parts thereof, which is very good where understood; but generally such utterly meaningless terms as, a certain part of an inch under one end of the level causes a given movement of the bubble, when nothing is known of the length of the level.

It is obvious that, whether expressed in degrees and fractions thereof, or not, the reading of variations indicated by a level is the reading of angles, and it would seem degrees and their parts should be used.

The writer would be pleased to hear from one or more qualified persons on this subject. So useful an instrument as the level is to the machinist should be better understood, and some generally understood method of expressing its readings should be in use.

Probably very few machinists have at their command levels so sensitive as to show a movement of ¼ inch of the bubble for 1/1000 inch variation of hight in 10 inches horizontal distance. Such an instrument may be said to be more sensitive than an ordinary micrometer, if comparisons between them may be established

In this same connection a description of the methods used to grind the tubes of very accurate levels would be of interest.

WILLIAM S. ROWELL.

Hamilton, Ohio.

A Gas Accumulating Firing System*

By Kurt Deinhardt

The Schnabel system involves the flameless combustion of gas, or a gas-air mixture, under pressure and inside of an incandescent refractory mass. Temperatures of 3600 degrees Fahrenheit and over have been obtained.

*From a paper presented at the Technical High School, Charlottenburg, Germany, by Dr. Herman Beck, for many years a coworker with Schnabel.

The temperature that may be reached in a flame is, in the main, dependent upon the reaction speed of the combustible gases. When gas mixtures are used, it attains its maximum if the fuel is supplied with the air necessary for complete combustion. Since the speed of combustion of such a gas-air mixture reaches a high figure, it is necessary, in order to prevent back firing—that is, the rushing back of the flame in the burner—that the velocity of flow of the gas-air mixture shall approximately correspond to this speed of combustion. On the other hand, if the velocity of flow of the mixture exceeds that of combustion, there occurs a separation of the flame from the nozzle of the burner.

The maximum thermal efficiency, with respect to the attainable temperature is therefore reached in a blast burner, when the speed of combustion and the velocity of flow are about evenly balanced. An increase of the temperature above this is not possible for, even if it were possible to prevent a separation of the flame at high rates of flow, no further intensification of the combustion process could be brought about. By reason of the injector-like suction of the atmospheric air at high velocities of gas flow, the gas mixture would be so diluted that it would gradually sacrifice the effect of its combustibility.

Moreover, an important technical and economic disadvantage of the blower flame lies in the fact that heat conduction proceeds with great rapidity, whereby the heat is powerfully dissipated in the air or open space and is never perfectly transmitted to the object which is being heated.

Schnabel's method prevents the separation of the gas flame at high velocities of flow. It is possible, in a very small space, to bring to combustion great volumes of gas, thereby attaining extraordinarily high temperatures, of 2000 degrees Centigrade (3600 degrees Fahrenheit) and over, such as formerly could not be reached even by combustion on the regenerative principle. Also, the process of combustion is carried on in an extremely favorable manner from practical and economic viewpoints.

The Accumulative Principle

An experiment which adequately explains the accumulative principle is as follows:

Let a mixture of illuminating gas and air flow out of a tube and ignite it. If the velocity of flow is suitably regulated, the flame will concentrate itself, burn blue and, as the outflow speed increases, lift itself from the burner nozzle in order to break away, since the speed of flow has become too great. If, however, we place over the nozzle a porous body formed, for example, of small pieces of quartz crystal the size of peas, so fused or stuck together that they adhere in a

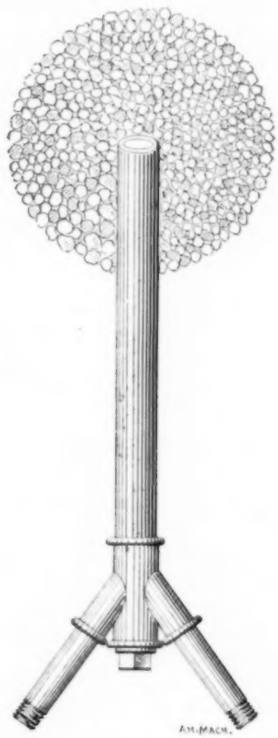


Fig. 1. Diagrammatic Representation of Combustion of Gases

mass about the size of an apple, Fig. 1, then the combustion of the gaseous mixture takes place inside of this body. If we turn on more and more illuminating gas and air alternately, and by correctly proportioning the air, recall to the inside any flame that may form on the surface, we can bring to combustion in the smallest space inside of the porous body, such a quantity of gas as might form a flame, say, one meter high.

This combustion is flameless combustion of the gas, or gas-air mixture, under pressure and inside of an incandescent refractory mass. We therefore do not have a combustion of the gases as free-playing flames, but as a flameless combustion under pressure and inside of the incandescent mass. In employing this process there is found to be an extraordinary increase of the temperatures formerly reached in gas burning. The reasons are as follows:

1. Damming up of the heat of the burning gases by their flow through the porous mass, which interposes mechanical resistance.
2. Storing up in the porous mass the heat thus held back.
3. Accelerating the combustion process through catalytic action (increase of the reaction speed) in consequence of the contact of the burning gases with the incandescent porous mass.
4. Combustion of the gases under pressure in such a manner that expansion is hindered and the combustion takes place in a smaller volume.

Use of a Granular Material

There may be used a solid body of certain porosity, but a loose material in small grains is quite as good. In the latter case the process is as follows:

We first turn on the gas and thus get issuing from the furnace an ordinary gas flame which, as soon as air is supplied, withdraws into the mass. Then there form on the surface of the mass small blue flames. Then a flat zone of incandescence forms, whose tendency is constantly to spread downward and finally cause a regular incandescence of the body filling the entire space. When the operation is started it is natural that only comparatively small quantities of gas can be brought to combustion, that is to say, in proportion to the volume of the incandescent zone. As soon, however, as this zone fills the entire space, large quantities of gas may be burned. The practical limit is so far only drawn by the degree of refractoriness of the material serving as the porous mass.

The detail arrangements of the method depend on the composition of the gas, its speed of inflammability and the relation of the porosity to the volume of the combustion chamber as well as to the kind of gas. If the interstices between the kernels of the porous mass are too large, it may cause back firing of the whole flame, such as takes place in the bunsen burner when the gas contains too much air.

It would be an error to assume that the unusual effect of this method is

chiefly a consequence of the higher pressure and mechanical accumulation of heat, although this may play an important rôle. There enters herewith a physical factor: That the combination of two gases in contact with bodies capable of catalyzing these gases takes place in a very different manner from ordinary. We commonly designate as catalysis the phenomenon, hitherto not very fully explained by science, that gases when brought in contact with the so called catalytic substances combine below their proper points of inflammability and raise these bodies to incandescence.* According to Schnabel's work and observations, the idea of catalysis must be so far widened as to embrace the intensification of the combustion process by the contact of gas with substances in general and not only those which have been distinctively known as catalytic. As already indicated, Schnabel has used substances of great variety, for example, highly refractory earths. In general, even if with certain gradual differences, he observed the same effect, that the substances when in an incandescent state, and therefore above the temperature of inflammability of the gas acted similarly in catalytic fashion. Without recourse to this consideration, the accumulative principle cannot be adequately explained.

[*This curious action known as catalytic is perhaps exemplified in a small pocket gas lighter recently put on the market in the United States. It consists of a tube shielding from mechanical damage, a point treated with some chemical substance which, when held in the flow of gas from an ordinary illuminating burner, quickly becomes incandescent and lights the gas.—EDITOR]

FIELDS OF USEFULNESS

In respect to its lines of application, the process can in general be used with practical and economic advantage for any purpose where gas combustion is today employed for heating.

The ordinary forge fires and heating and hardening furnaces may be improved by using, instead of coke, an incombustible granular material heated by a gas mixture according to the accumulative principle. See Fig. 2. The advantages in this would be the avoidance of laboriously clearing out the unburned coke residue and the fact that the zone of incandescence is indifferent chemically. Moreover, the furnaces using this process can quickly be put in and out of service.

The employment of this system for heating forgings will prove especially advantageous where very large pieces have to be heated only in certain parts, say for welding or forging.

The method is applicable to heating of firing ovens for ceramic purposes.

Very good muffles may be designed by surrounding them with a porous mass. See Fig. 3. Further, the burning and calcining of refractory materials can be performed by arranging them to constitute the porous mass. Similarly, one can conceive of cement burning by this new process.

Another great field of utility is the chemical industry. Here come in question all those processes requiring the greatest possible incandescent surface.

A further province of use may be the firing of boilers which could be bedded in the porous substance and so uniformly heated.

The chief domain of utilization naturally is metallurgy, wherein the process may be used for welding and melting. The small types of Schnabel furnaces, Fig. 4, are ideal for laboratory purposes; they allow us to get temperatures of some 1600 to 2000 degrees Centigrade (2900 to 3600 degrees Fahrenheit) which hitherto have been produced only under difficult conditions.

The process may be used in blast-furnace practice for smelting substances which require either extremely high, or lower, easily adjustable, uniform temperatures. In crucible-steel production, the new process is perhaps best conjoined with the Martin furnace for further heating of the already fluid material. The steel-melting tests conducted in the Charlottenburg Hochschule showed that, with the Schnabel process, it was possible to melt small quantities of steel in a very few minutes. Thus by the little furnace used, a quantity of steel large relatively to the furnace size could be brought to fluidity in from 2 to 4 minutes.

The laboratory furnace, Fig. 4, is constructed as follows: A graphite crucible is filled with the porous substance. In the midlde of it is bedded the melting crucible proper. When constructed on a large scale, which has already been carried out, the crucible does not have to be removed after the melting, but the whole arrangement, firing chamber along with crucible, can be tilted, so that the

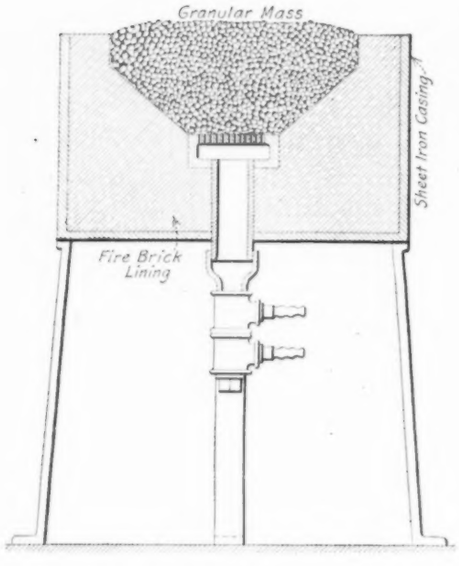


FIG. 2. FORGE FIRE ACCORDING TO ACCUMULATIVE SYSTEM

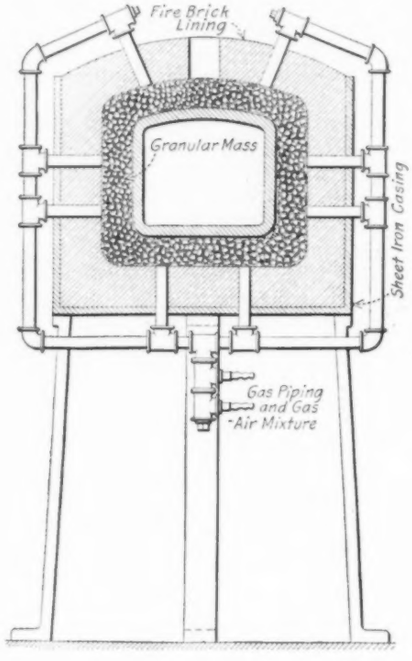


FIG. 3. MUFFLE FURNACE ACCORDING TO ACCUMULATIVE SYSTEM

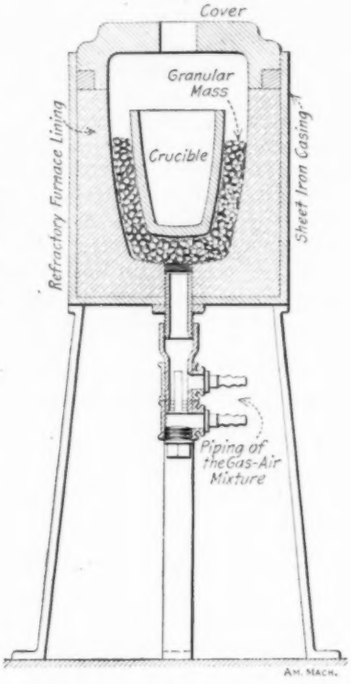


FIG. 4. CRUCIBLE MODEL ACCORDING TO ACCUMULATIVE SYSTEM

crucible remains seated in the porous mass until it is quite used up. Beneath the larger crucible, which serves as a combustion chamber, the gas mixture is introduced. For the small models an ordinary two-way cock suffices. For large models there is an injector form of feed. With this apparatus temperatures of 2000 degrees Centigrade (3600 degrees Fahrenheit) and above could be reached.

The exploitation of the process is in the hands of the Thermotechnischen Gesellschaft *m. b. H.*, established for the purpose in Berlin under the technical management of the inventor.

Conference on Business Management

By Hugo Diemer *

Notes on the Dartmouth conference where some 400 manufacturers and business men discussed subjects of business efficiency and management.

*Professor of Industrial Engineering, Pennsylvania State College.

Dean H. S. Person and the Tuck School of Business Administration of Dartmouth College deserve credit for bringing together at that institution, some 400 business men and manufacturers principally from the New England States, for the purpose of hearing addresses on the subjects of Business Efficiency and Scientific Management. While the formal addresses were delivered primarily by well known experts whose experience has been chiefly in the installing of systems of management, the meeting brought about a general interchange of opinions and experiences, which added in no small degree to the benefit of the occasion. The attendance at discussions and the close attention to them was in favorable contrast to the attendance and attention at conventions of the national engineering societies, where of late years the tendency seems to be for a minority of the persons attending conventions to be present at the addresses and discussions.

Readers of the engineering publications are so familiar with the methods of the well known speakers who attended the convention, that it is unnecessary to dwell at length on such portions of their addresses as had to do with these matters. On any occasion there is, however, a likelihood of presentation of a known principle in a new way, or the bringing forward of matters which have not been previously dwelt upon. It was with an appreciation of this fact that the following impressions on the convention were recorded.

Mr. Taylor's Address

F. W. Taylor's address, the delivery of which consumed a full two hours, was replete with principles and examples drawn from his former writings on the subjects of factory management and the art of cutting metals. He brought out more strongly, certain points in his address which have not been dwelt upon in quite the same manner as in his previous writings. Among these are the following:

It is our fault that workmen feel it their duty to go slow. This is particularly true in organized industries. This condition is the most serious problem facing the English nation at this time. The workmen firmly believe that if they cut down to one-half the time in which they have been doing the work, that one-half of the working men will be thrown out of employment. On the other hand the history of industry shows that an increase in output in any trade has always resulted in more working men being employed in that trade. In the early days of the cotton industry, this fallacy of the supposed over-production throwing men out of employment, caused the destruction of machinery in Manchester by the working men. In 1840, there were in Manchester, 5000 cotton operatives; there are now 26,000 such operatives in that city. Moreover each operative can turn out eight times as much as could be done by the hand process.

The real wealth of the world is measured by what man produces. Any institution that will restrict output as a permanent policy is an enemy of the public.

The first obstacle then, in the way of industrial efficiency is the fallacy of over production.

The second obstacle is our own inefficient systems of management. The first step toward scientific management is to educate the management so that it knows at least a portion of what the working men know. This process inevitably results in a complete revolution of former views of labor and employment toward each other. History shows that neither the working man nor the manufacturer can expect to gain for his class the entire benefit of increased production during any long period of time. The greatest gain under scientific management is the establishment of more cordial relations between employee and employer.

Another great benefit of scientific management is in the new and unheard of burdens assumed by the management; this is due to their new duties. The first of these duties is gathering in the knowledge possessed by the workmen, which has never been written anywhere, classifying and tabulating it, reducing it to laws and rules and, in many cases, mathematical formulas, thus replacing the former knowledge by science.

The second great benefit is the scientific selection and progressive development of the workman.

The third benefit is the bringing together of the scientific knowledge of the trade and processes and the methods of the working men. The management is usually more stubborn than the men.

The fourth benefit is in the division of the entire system of production into two sections; one section being handed over to the management, the other the working men. The justification of the term, scientific management, is found in the definition of science, as organized or systematized knowledge. This definition is given by Mr. MacLaurin of the Massachusetts Institute of Technology.

Mr. Gantt's Address

H. L. Gantt's subject was "The Task and the Day's Work," in which he called attention to the broad aims and objects of the leaders in the scientific-management movement. The work to be done is not merely to evolve a series of expediences to promote efficiency; we are endeavoring to solve the industrial problem which is the greatest problem before this country today. The term, "Efficiency Engineer" is a misnomer. The true engineer has always been a man who has learned to utilize thoroughly the materials of engineering.

Before we can accomplish any results in connection with wage systems it is important, first, to organize and systematize the order of work. In other words, we must introduce scheduling and planning. These problems must be solved first. We can then solve the problem of the individual workman later, in the meanwhile keeping up a system of accurate records.

In installing scheduling and planning systems, experience in many shops has shown that it is the rule rather than the exception for foremen to make promises and forget them. After making out a daily schedule these foremen were delighted. After having devised a planning and scheduling system, we must devise means for knowing each day whether our schedules have been lived up to. After installing a planning system and leaving it in the hands of the owners of a business to operate, it has often been found that it was not carried out as planned. On being turned over to the subordinate shop officials, these subordinates with their narrow experience, thought they could improve on the methods of the ex-

perts with wide experience, who had installed the system, the result being that the system failed absolutely.

In the ordinary machine shop the amount of work moving in a desultory way through the factory is about three times in bulk and in number of orders that should be in the shop. This not only takes up space but interferes with the flow of product.

In establishing time standards the man who fixes rates must not be a clerk given a stop watch, he must be a man who knows what a proper task is and preferably he should know how to do it. Before beginning task setting for the workman we must arrange all other conditions so that he can work to best advantage. These conditions include lighting, heating and ventilation. The investigator and task setter should be able to be an instructor.

In this respect Mr. Gantt's opinions, as expressed in his paper, differ from those of the writer, whose experience had been that success could be obtained by using a time-study man who had had the benefit of training in taking observational data, and using in connection with him, a demonstrator selected from the different shop departments in which the time-study work was being done. I have always believed that a team of two men selected in this way can secure much better, all-around results than can be obtained from an attempt to secure a man who is both expert at taking time observations and at giving instruction in machine tools. There are a few men who have ability to operate a wide variety of machines. In fact, a man claiming to be able to operate a wide variety of machines and also an expert time-study man, must be either a prodigy or a fakir. The chances are ten to one that he is the latter.

Under modern machine-shop conditions, including the use of high-speed steel and high-power machine tools, the changing of jobs is three times as frequent as under old conditions; hence, the time consumed in changing jobs becomes far more important than it used to be.

The ratio between the number of men doing shop work and those engaged in planning work must be entirely different from the ratio under older conditions. This is true not only in metal-working plants, but in other industries in which modern efficiency methods have been introduced. For instance, in bleaching cloth, one of the processes is the subjection of the cloth to the action of the acid. On investigation it was found that sometimes the cloth was subjected to the acid for only five minutes. It was found that the strength of the solution varied from about 1 per cent. to 7 per cent. On making a series of tests, it was found that ten minutes' subjection to acid was ample to cover the case. Similar investigation of methods of piling the cloth resulted in the introduction of devices which reduced the time required for this process to about one-third of what had previously been consumed.

Mr. Gantt stated that until financiers and selling agencies fully appreciate one of the fundamental laws of economics, that small profits make good business, the work of the producer in decreasing costs will not amount to much. High profits tend to reduce business economy and efficiency.

Mr. Emerson's Address

Harrington Emerson's address was on the "Opportunity of Labor under a System of Scientific Management." His address was largely informal, although he referred frequently to notes and memoranda. He dwelt particularly upon the large wastes which had been brought to light as soon as an investigation of efficiency of various processes was made. He emphasized the fact that cost of any product consists of three factors; cost of materials, cost of labor, and fixed charges. In considering cost of materials, we have two factors, quantity times price. In the past we have dwelt too strongly on questions of price and not sufficiently on questions of quantity. In labor the cost consists of the product of time multiplied by rate of wages. In the past we have dwelt too strongly on the rate of wages and have not concerned ourselves sufficiently with time.

The cost of the fixed charges is the product of the time multiplied by the rate. Here again we have concerned ourselves more with the rates and not sufficiently with the time factor.

By the introduction of several hypothetical cases, Mr. Emerson demonstrated how high costs of high-grade material coupled with low consumption in quantity, were entirely compatible with economy and efficiency, particularly in the matter of supplies. In the same manner he demonstrated that high wages going hand in hand with low time units for accomplishing work, are compatible with standards of high efficiency. Also fixed charges per hour, much higher under efficient management than under efficient management, should, when coupled with low time units, be compatible with low total costs.

H. P. Kendall spoke on the subject of "Types of Management." He divides all types of management into three classes, namely Unsystematiped systematized and scientific. His discussion was drawn almost entirely from a paper which he had prepared in delivering testimony before the Interstate Commerce Commission.

Each type of management may be investigated by considering five phases as they exist under each type, namely: (1) Accounting, (2) Purchasing, (3) Storage of Material, (4) Expedition of Work, (5) Efficiency of Workers.

Probably 70 per cent. of the manufacturers of the country would come under the heading of unsystematized management. In the unsystematized business, the main feature is the annual statement which shows merely the results of the past year. The managements of a great majority of manufacturing businesses, do not know definitely whether they have made a profit or loss until months after the close of a fiscal year.

Systematized management will show comparative reports. In costs it will show the where but not the how.

Scientific management will show the how as well as the where. It will show the expense accounts, profits and losses, assets and liabilities at the end of every four weeks. Under scientific management costs come as a byproduct of planning.

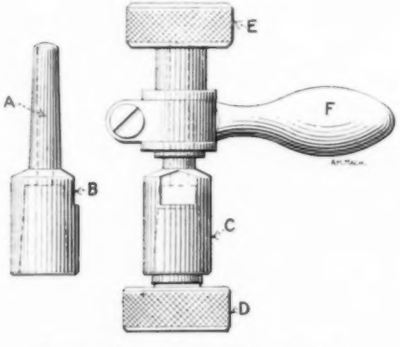
Drilling a Long Drift Hole

By Gus Haessler

There is considerable work for which reasonably approximate methods are very satisfactory, inasmuch as the workman is relieved of much unnecessarily accurate labor, at the same time reducing the cost of the work.

The long hole *A* in the piece *B* was drilled after the piece had been otherwise machined. This piece was used as a holder for a bronze lap and the drilled hole was simply a drift hole for use in driving out the lap, so absolute accuracy was not required, and the jigging arrangement used while drilling this hole is shown at *C*.

D is a drill bushing that fits into the hole bored for the bronze lap, and *E* is



Jig for Drilling a Drift Hole

a drill bushing that fits over the shank of a holder, as shown, the handle *F* being a standard quill wrench, which is clamped onto bushing *E* as a handle. This arrangement was used in a bench lathe with one bushing held against the drill pad, while half the depth of the hole was drilled, when it was reversed and the hole finished.

The drill bushings were made of nurled tool-steel stock, hardened, ground and lapped.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For October,* 1911 *(American weekly, American monthly, English weekly and German weekly) total,* 94,750.

Of this issue 22,000.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 133

American Machinist

The Automobile as a Fosterer of Repair Shops

It would be easy to develop this title in a facetious vein by dwelling upon the experiences of motorists when something goes wrong, and their final, agonized rush to the repair shop for help. A sequel to this could be given with plenty of local color showing a car owner receiving his bill from the repair-shop proprietor. But the subject deserves an entirely different treatment.

During the last few years a large number of small machine shops have grown up, brought into being by the necessity for automobile repairs. When well managed and successful they are furnishing a new element of strength to the machinery-building industry as a whole.

This development is particularly noticeable in the Middle West, where probably several hundred such shops could be easily listed.

The growth has been something like this: One or two or three energetic young men have noticed the buying of cars in some town and have appreciated that repair work was forthcoming. They have started a small automobile repair shop, usually with only a few machine tools and a very limited equipment. As their automobile work increased and attained a standing as good, honest work, gasolene-engine repairs began to drift in. Then the fixing up of farm machinery naturally followed. A little later the repairs from local industries, such as the creamery or canning factory or other plants using machinery, began to be brought in. Then perhaps an extension of the business to the making of machine parts for replacement, rather than going to the trouble of ordering these pieces from a distance with the accompanying wait. Thus in time a well rooted vigorous jobbing business is built up.

The next step, one which probably only a few of these shops have yet taken, is manufacturing some machine or specialty that may promise to give an added permanency to the business.

All such shops that are wisely managed and successful will prove to be an element of strength to the machine-building industry. Undoubtedly the development of small and medium sized machine shops is to be encouraged, and the automobile is fostering just such shops. These have furnished a market in the past for a number of simple machine tools though many have been second hand. As the growth that we have sketched takes place they will require others, and some that are more highly organized. This provides one machine-tool market which should not be neglected by the builder.

Opaque versus Clear Glass for Shop Windows

Light, both natural and artificial, is a prime factor in shop work. The well designed shop building will be equipped with ample facilities for providing an abundance of daylight through liberal and unobstructed windows and skylights; these reduce the amount of artificial light required and promote that spirit of cheerfulness which is so noticeably lacking in the gloomy shop. A recent letter in our columns has called attention to the necessity for adequate daylight facilities, and has furthermore emphasized the advantages and disadvantages of opaque and clear glass for shop windows.

In any item relating to the shop economy, as for example the choice of one or another type of glass for windows, a broad view must be taken. While there is some reduction of the light transmitted through opaque, wired-glass windows, other considerations must necessarily be given weight, notably the reduced fire risk in those cases where the shop faces and is close to other inflammable structures. Here wired-glass is a safeguard. While its use does not generally reduce the insurance-premium rate, still it is recommended by fire-insurance inspectors for such locations, and shop managers readily fall in line for the benefit of the fire protection afforded. Wired-glass must be used in conjunction with steel window frames, and although considerably more expensive than clear window glass in wooden sash, it is considered an economy for the reasons just stated.

Opaque wired-glass cuts down the quantity of light admitted into the building to some extent, but complaints based on this feature will often be found to be due to dust and dirt on the outside, for its irregular surface affords a ready lodgment for such accumulations. If these windows are maintained by moderately frequent cleaning, the difference between the opaque wired-glass and the plain, clear window glass will not be a very large item. Where, however, the question of glass for roof windows or skylights is involved, the wired-glass is considerably more advantageous than the plain, clear glass, in that it reduces the glare from the bright sunlight, and affords protection from objects which may fall upon the roof from above.

Opaque glass obstructs the view of surrounding buildings and country. This may be objected to by the workmen themselves, but in practice it is found that this feature promotes attention to the work by the removal of the temptation to look out of windows, with the consequent disturbing elements of distracted attention.

Where benches are located directly against and facing the walls, the windows with any type of glass should extend down almost to the bench surface. Exact work on such benches will be performed at a disadvantage, as far as daylight is concerned, in front of windows, the lower portions of which are a foot or more above the bench surface.

Clear wired-glass might be suggested to offset the relatively small disadvantages of opaque wired-glass, but its cost is such as to make it prohibitive for the average shop. Where, therefore, a building faces no other structure, thus eliminating the fire risk from without, clear plain glass may be used for the side windows with some advantage in the matter of ease in keeping clean and in the lower first cost, but in those cases where adjoining buildings exist, or where the light is admitted from above, the windows should be equipped with wired-glass. With due care in cleaning, and with the proper location of windows, the advantages with wired-glass as enumerated will

usually far more than offset any relatively small disadvantages in the matter of somewhat less light and higher first cost.

Shop Ventilation

It may seem a little odd at this season of the year to remember the heated term of last July. Those who usually look for a profit from their business, however, can refresh their memories by looking up the balance sheet for that month. Why were shops kept open at all through that extreme weather? Habit for one thing. To enable their workmen to live for another. So far as profits are concerned most shops might well have shut down completely.

If another hot wave comes next year what will we do? Will we simply sweat and say that it is hot; or will we try to make our shops, if not comfortable, at least less uncomfortable than other places? Not more than one shop in 50 has any provision for stirring the air in it other than to open the windows and pray for a breeze. The forge shops and foundries are not so bad as they sound, because the heat at least dries the air, thus dodging that great enemy of the race, humidity.

A shop which is so fortunate as to be heated by a hot-blast system can, but seldom does, run the fan and blow in outdoor air. It is too Utopian—or, rather too expensive—to hope that someone will connect a refrigerating machine to the coils and furnish cooled air. To circulate cooling brine through the pipes in a steam-heated shop is, of course, out of the question, and is not what is wanted. Only moving air will fill the bill. Fans driven from the main line, keeping the air within the shop stirred, really accomplish little more than create an impression that the employer is trying to do something to allieviate suffering. Ventilating fans drawing air from the north side of the shop, with suitable provision for straining it of dust and smoke if present, furnish the most feasible and inexpensive method of ventilating.

After all the principal point is that these things need attention in a normal summer only in a little less degree than they did last summer. And the time to attend to them is now when they are not needed for immediate use.

Wanted—Intelligent Design

Machine designs are too often evolved in one or two ways; in one, the sporting way, the original, totally inadequate strength of the machine is patched up bit by bit until a model is found that will stand; in the other, the conservative way, a clumsy, safe design is pared down until the limit of strength is found.

That either of these ways of designing is really intelligent no one can believe. It is an arraignment of engineering knowledge to admit that either method is followed at all. Yet we all know that exceptions are so rare as to only prove the rule. Is it possible that all the study that has been given to the strength of materials, that has made possible the design of safe and economical bridges and trusses, is to have no counterpart in the design of machinery? To be sure there are isolated and well-nigh forgotten works on gears, pulleys, etc., but still no one but the veriest tyro expects that a designer will produce a machine of the simplest character by any other means than we have cited above, unless it be by direct copying. Fortunately there is a great range of proportion to most machine parts, within which they do not fail, which is not the same thing as saying that they succeed.

A bearing has been located in a machine, it is found desirable to locate another gear on the shaft and room for it is made by cutting off the bearing. The designer's judgment was that the length of the bearing was right before he cut it off, and it is still his judgment that it is right afterward or he would not cut it off. Or he wants to design a hanger. He finds an empirical rule for its principal dimensions and draws it in. It looks heavy and out of place with the rest of the machine, so he cuts it down with unsparing hand and decides it is right, justifying himself by saying that the fellow that got out the formula must have been designing rolling mills.

That this illustration is not overdrawn must be recognized by every man who has occasion to use the numerous machine-design books that make a specialty of empirical dimensions for the common typical parts of machines, leaving the searcher totally in the dark about anything off the beaten track.

The use of these books is, perhaps, responsible for a large part of the lack of appreciation which technically educated men find when they are thrust out into this hard, cold world.

A. S. M. E. Monthly Meeting

Autogenous and electric welding is to be the subject discussed at the November monthly New York meeting of the American Society of Mechanical Engineers, to be held on the evening of November 14, in the Engineering Societies' building.

Three papers will be presented: One dealing with the general aspects of the subject, by H. R. Cobleigh; and two on special phases, thermit welding, by G. E. Pelissier, and electric welding, by C. B. Auel.

There will be open discussion grouped about the following topics: Electric resistance welding; electric arc welding; thermit welding; oxyacetylene welding; oxyhydrogen welding.

Sixth Congress of the International Association for Testing Materials

The sixth congress of the International Association for Testing Materials will be held under the patronage of the President of the United States at the Engineering Societies' building, New York City, during the week beginning September 2, 1912.

The nature of the work for which the congress will meet is concisely described in section 2 of the bylaws of the association as "the development and unification of standard methods of testing; the examination of the technically important properties of materials of construction and other materials of practical value, and the perfecting of apparatus used for this purpose."

Another of the most important functions of the association is the establishment of standard specifications for materials used in manufacture and construction.

H. F. J. Porter, 1 Madison avenue, New York City, is the secretary of the organization committee of the congress, and all communications concerning the congress should be addressed to him.

Personals

George F. Gast, formerly chief draftsman and constructing engineer with Walter Kidde, New York City, has accepted a temporary engineering position with the San Francisco Bridge, San Francisco, Cal.

L. C. Milne, of the American Mill Supplies Company, is in New York for the purpose of looking up additional American goods to sell in Great Britain. He will be located at the office of George V. Cresson Company, 60 West street, New York.

H. N. Anderson, chief engineer of the Speedwell Motor Car Company, Dayton, Ohio, has tendered his resignation, to take effect Dec. 1, 1911, and intends to give his entire time in the future to his new process of rolling the teeth in steel gear blanks while hot.

David Van Alstyne, vice-president of the Allis-Chalmers Company, in charge of manufacturing, previous to which position he was vice-president of the American Locomotive Company, has resigned. C. E. Search, formerly assistant to Mr. Van Alstyne, has been appointed works manager.

H. E. Townsend, for the past seven years chief draftsman of Hans Renold, Ltd., Manchester, England, and formerly with the Brown & Sharpe Manufacturing Company, has resigned his position in England and is now in this country. His present address is 456 West avenue, Pawtucket, R. I.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

A Portable Painting Outfit

The halftone shows a portable painting outfit, built by the Eclipse Air Brush and Compressor Company, Bloomfield, N. J.

The outfit consists of a truck, upon which is mounted an electrically driven air compressor and receiver with hose connection to the hand-controlled atomizer. These atomizers are made in various sizes, and will apply anything from lacquer to the heaviest enamel. Though the spray is almost as fine as a vapor, the compressed air gives it force, causing it to penetrate such work as porous castings in a way that cannot be accomplished with the ordinary brush.

It works equally well on smooth, rough, flat and irregular surfaces, and the spray is easily applied into crevices and corners which would be inaccessible to the brush. One man with the atomizer

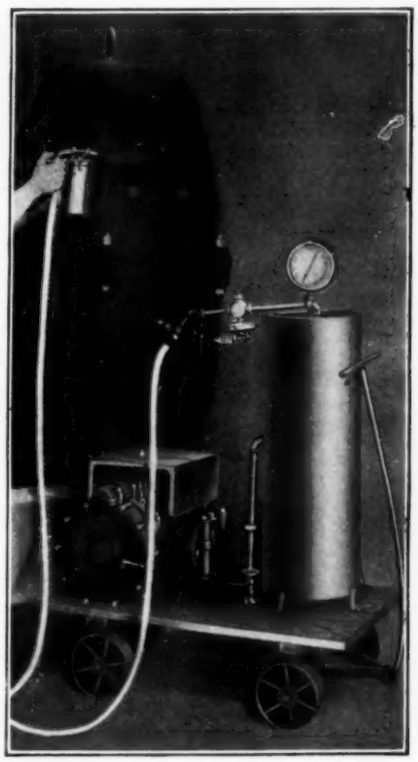


FIG. 1. A PORTABLE PAINTING OUTFIT

can accomplish as much work as four or five men with the brush, and the work of the atomizer compares favorably with that of the brush.

Fig. 2 shows the atomizer in section. The fluid reservoir *R*, made in one piece of sheet steel, is filled with paint. The cover is made of brass and is held in place by two wing nuts, not shown. The hose from the air compressor connects at *H*. A thumb valve *P* opens or closes the tube *A* at the will of the operator. A needle valve *V* in the tube *A* is regulated so as to admit a certain amount of air on top of the paint in the reservoir. The check nut *M* holds *V* in any desired position. The nozzle *N* connects at the back with the tube *A*, by means of the sleeve *G*. Small holes *K*, drilled at an angle, give the air a circular motion before it reaches the tip *T*. The tube ending at the tip *T* reaches down to near the bottom of the reservoir.

The action of the atomizer, or air brush, is as follows:

The tank is filled with paint and the cover with the rubber gasket *W*, screwed down into place. The air at from 5 to 30 lb. pressure is turned on and the needle valve *V* opened slightly. Final regulation of this valve depends on the work being painted and the paint being

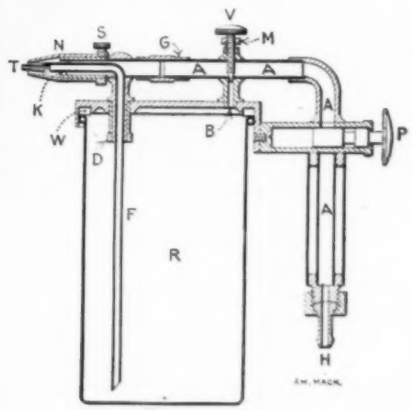


FIG. 2. THE ATOMIZER

used. As the air rushes out of the nozzle *T*, a partial vacuum is produced at this point, this in conjunction with the pressure of the air, from the valve *V*, in the top of the receptacle, causes the paint to flow up the tube *F* and out of the tip *T*, where it is caught by the whirling air current and deposited on the work.

Where the material is thick and must be kept from settling at the bottom of the reservoir, a tube reaches from *B* to the bottom of the tank *R* and the air rising through the fluid keeps it agitated.

When refilling becomes necessary, a relief valve, not shown, relieves the pressure in the reservoir.

All parts are readily accessible for cleaning and the whole atomizer can be entirely taken apart in a few minutes.

These air brushes can be installed in any plant where 30 lb. air pressure is available and at this pressure about 6 cubic feet of free air per minute is required for each atomizer.

Three Spindle Driller

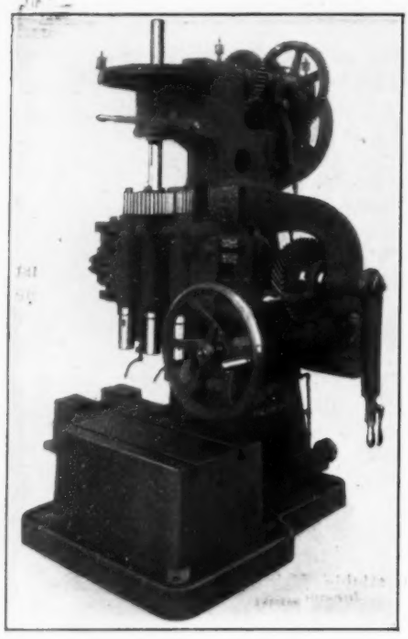
The accompanying halftone shows a special machine designed to drill simultaneously and tap simultaneously the three core holes in contactor pole pieces of motors. The capacity is for drills up to 1¼ inches and for taps up to 1 inch in diameter, the speeds ranging up to 50 revolutions per minute for tapping and up to 200 revolutions per minute for drilling.

The spindles of the machines are 1⅞ inches in diameter, fitted with a No. 4 Morse taper with retaining and drift key-slots. The bearing of the center spindle is cast solid with the saddle and that for the two outer spindles is adjustable on the saddle through a distance of from 3¼ inches to 10 inches between the centers of adjacent spindles. The maximum distance from the ends of the spindles to the top of the work table is 20 inches. The work table is 18 inches wide, 30 inches long and is fitted with two cored T-slots.

The drive to the center spindle is by belt from the motor through intermediate spur and bevel gears, and that for the two other spindles is transmitted through intermediate steel spur gears mounted on swing arms, which have an extension for bolting them securely in position when properly adjusted, as is shown.

The lever extending beneath the plate has hand vertical adjustment and reversing power feed with two belt changes. This motion is transmitted to the saddle by means of rack and pinion.

The level extending beneath the plate bevel gear is for engaging the No. 6 double Carlyle Johnson friction clutch, by the engagement of which two to one reduction and a reverse for tapping are obtained. The lever for engaging the



THREE-SPINDLE DRILLER

drive direct for drilling and also the 40-tooth pinion for the reduction in speed is shown. Immediately back of this lever on the same side, and attached to and to be adjusted with the saddle is shown the handwheel for the hand adjustment, the knocker arm for engaging the feed motion, the lever for adjusting the clutch, which transmits the motion to the pinion shaft, and also the ratchet for the adjustment.

The tank for the lubricant is mounted in the base of the machine and the equipment includes pump and piping. The machine as shown is entirely surrounded by an oil pan.

The motor drive consists of a Westinghouse type "SA" 8½-horsepower 400-1600 revolutions per minute motor. The machine is a recent product of the Newton Machine Tool Works, Philadelphia, Penn.

A Horizontal Cylinder Borer

The halftone shows the new pattern No. 2 Barrett horizontal cylinder borer built by the Barrett Machine Tool Company, Meadville, Penn., designed for simultaneously boring and facing steam, gas, gasolene, pump and locomotive cylinders.

The machine is mounted upon a heavy bed 13 feet 1 inch long. The widened portion is 48 inches wide by 56 inches long by 18 inches high, with the platen top, having 8 cross T-slots and two longitudinal T-slots for conveniently securing jigs and work.

The pedestals are 20 inches from the top of the bed to the center of the boring bar and the tail pedestal is adjustable on the bed from zero to 48 inches.

The boring bar is 5 inches diameter, made of 50-point carbon hammered steel and has a continuous feed travel in either direction of 48 inches, that is, it will bore out a cylinder of this length at one setting. The end is fitted with No. 6 Morse taper hole with draw and drift slots so that smaller bars can be used when necessary. In this case a sleeve is placed in the tail pedestal bearing for supporting outer end of the smaller bar.

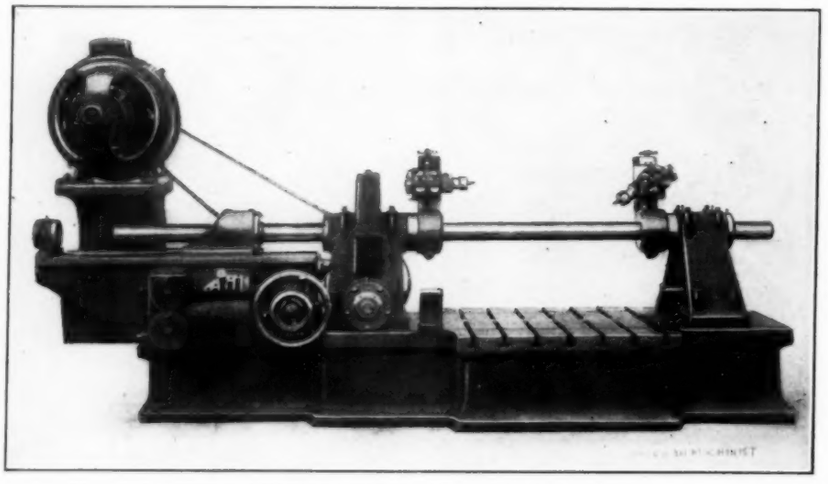
The machine is equipped with a quick-change feed-box mechanism, having 10 different feeds as follows: $\frac{1}{32}$, 3/64, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{8}$ and $\frac{7}{16}$ inch per revolution of the boring bar, any of which is almost instantaneously available.

The power is transmitted by the Hindley type, worm and worm-wheel, double left-hand thread, affording a very smooth and even motion to the boring bar.

The machine is equipped with two facing arms which are mounted on the ends of sleeves. They are driven by friction and may be started and stopped at will by simply tightening or releasing a collar bolt. When not in use they hang on the ends of the sleeves and do not interfere with the rotation of the boring bar or the longitudinal travel. They are provided with a sliding block which travels at right angles to the boring bar. This block is fed in and out with a star feed and mounted upon this is a secondary block which carries the tool for facing off or turning the outside diameters of cylinder flanges. The tool in the sliding block is made of 1-inch square stock and when placed in the lower slot can be fed down within 1 inch of the boring bar, making it convenient for facing small cylinders. As it is withdrawn from the back end, the tool can be readily removed without changing the position of the block.

The machine is furnished with either belt or motor drive. The belt-driven machine is provided with a four-step cone pulley with steps 13, 16, 19 and 22 inch diameter, with corresponding cone on the countershaft. The countershaft has two friction pulleys 16x5 inches for double speed, giving eight speeds to the boring bar.

The machine shown in the halftone is driven by a 10-horsepower 4 to 1 variable speed motor, mounted on a bracket bolted to the side of the extended frame of the machine, the connection being made to the driving shaft by an endless belt. This places the motor out of the way of dirt and chips and no additional floor space is necessary.



A HORIZONTAL CYLINDER BORER

An Electric Recording Instrument

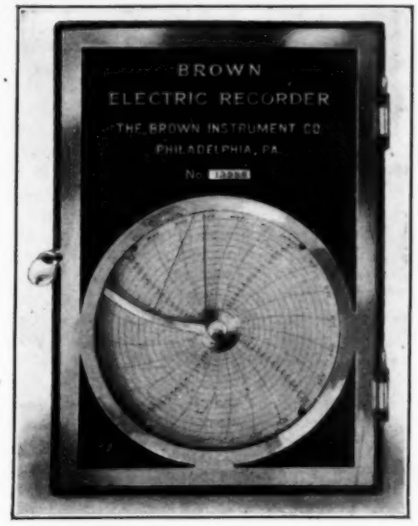
The halftone shows an electric recording instrument which can be used as a pyrometer, recording voltmeter or ammeter. It is built by the Brown Instrument Company, Philadelphia, Penn.

The essential parts of the instrument are mounted on the door instead of in the case. The clock mechanism and chart alone remain in the case when the door is opened. Consequently there is no possibility of bending the pen because there is no occasion to handle it for any reason whatever. As soon as the door is thrown open the entire voltmeter system and the inking device is swung aside automatically, permitting the old chart to be easily removed and a new one substituted.

The millivoltmeter system which is used in this new recording instrument is a simplified form of the D'Arsonval system which is the system used in electrical instruments of precision. The recording pen comes in contact with the paper momentarily only for the purpose

of making a dot, thereby eliminating all friction between the pen and the chart.

An inking pad carrying sufficient ink for a week's supply is placed immediately beside the pen. This inking pad touches the pen point frequently, keeping it damp. When the door is closed the arm operated by clock mechanism, comes automatically in contact with the inking device, and every half minute or quarter minute if preferred, it pushes the inking pad away from the pen permitting it to swing freely. It then falls, allowing the inking pad by its own weight to press the recording pen against the paper.



AN ELECTRIC RECORDING INSTRUMENT

Foundry Wire Brushes

A new line of foundry wire brushes has recently been produced by the F. & M. Brush Company, Worcester, Mass. These brushes are made of oil tempered flat wire, which is tempered to take a right-angle bend. The wires are bent before they are placed in the body and are then kept in position by a caver.

The body and cover are made of hard wood of uniform size, planed and smoothed, and are fastened together with two 3/8x3/64 steel clamps, which are forced over and locked on the under side.

The brushes have reinforced ends, each end having 24 extra wires which serve to take the brunt of the thrust as the brush is passed forward and backward.

Ceiling Riveter

The ceiling type of rotary rivet-spinning machine, illustrated herewith, is a recent product of the Grant Manufacturing Company, Bridgeport, Conn.

The motor is direct connected to the spindle of the machine, is incased in a cast-iron frame and the whole is suspended from the ceiling by tie rods. The pedestal or anvil is bolted in position on the floor, thus permitting the work to be swung around. The machine is operated by a hand lever, which is placed in such a position as to be easily accessible and at the same time away from the work.

This machine is especially adapted for riveting on automobile bodies, hoods and other light work of a bulky nature or irregular shape.

CEILING TYPE OF RIVETER

A New Tap Grinder

The Bicknell-Thomas Company, Greenfield, Mass., is manufacturing a neat little grinder, shown in Fig. 1, intended for sharpening taps up to 1½ inches in diameter. This grinder has a countershaft bolted to the back of the column and may be belted direct from the drive shaft.

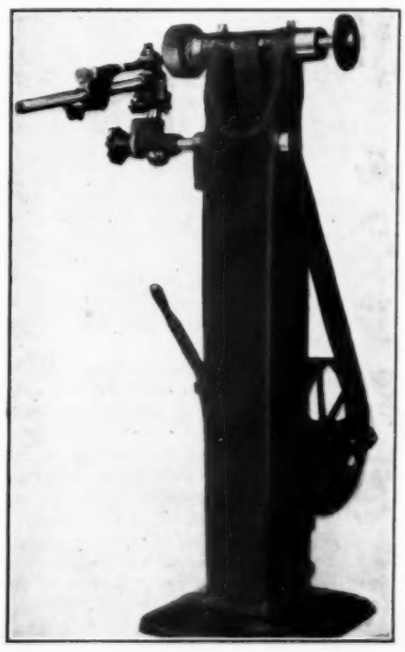


FIG. 1. BICKNELL-THOMAS TAP GRINDER

Fig. 2 shows the tap-grinding fixture in detail. The tap is held between centers *A* and *B* and is swung past the face of the cup wheel by using *C* as a handle. *D* is the spring finger for holding and indexing the tap, and hand nut *E* is used to feed the tap onto the wheel after the swinging head and spring finger have been set so as to give the tap the proper angle and position for grinding the clearance.

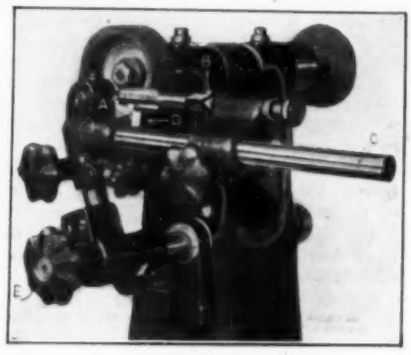


FIG. 2. DETAILS OF THE GRINDING FIXTURE

A wheel for general grinding may be used on the opposite end of spindle. The machine is furnished complete with belt and wheels and the shipping weight is approximately 225 pounds.

Box Column Driller

The Sibley Machine Tool Company, South Bend, Ind., has recently developed an improved type of all-geared driller.

The speed box is located on the top of the column which position necessitates the use of only one pair of bevel gears to deliver power to the cutting tool. Eight speeds are instantly available. The feed gears, which are semi-steel, are always in mesh and the changes are effected by an internal key.

The main driving shaft which rotates the spindle directly also drives the feed mechanism and the reduction gearing is of such a ratio that a heavy feed is obtained. There is only one pair of steel bevel gears in the entire feeding mechanism and these, together with the rest of the gears and the steel worm, are inclosed and run in an oil bath. Four changes and a neutral position are obtained by moving a small knob in the center of the handwheel. The lubricant tank, the pump, and all pipes are inclosed within the column. The machine has a swing of 24 inches, maximum distance between spindle and table is 27 inches. Drills ranging from ¾ to 1¾ inches can be handled in this machine and the minimum and maximum speeds of drills are 75 and 450 revolutions per minute respectively.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The City Coal Company will erect a garage on Garden street, Hartford, Conn.

The New Britain Gas Light Company, New Britain, Conn., will erect a garage in the rear of its plant.

The Farrell Foundry and Machine Company is to erect a two-story addition to its Ansonia (Conn.) plant.

Richard J. Dillon will erect a garage on High street, Hartford, Conn. The basement will contain a boiler room.

Work has been started on a two-story garage and shop to be erected on Mason street, Springfield, Mass., for Edwin Perkins.

The Progressive Jewelry Company, Providence, R. I., will open a factory in that city for manufacture of hat pins and belt pins.

The Stanley Rule and Level Company, New Britain, Conn., manufacturer of carpenter's tools, will erect a new factory at Plantsville, Conn.

The American Steel and Wire Company, Worcester, Mass., manufacturer of milling ma- erect a $15,000 addition to its plant on Ballard street.

The Universal Car Wheel Company has leased a part of the American Bridge factory in Berlin, Conn., and will engage in the manufacture of trolley wheels.

The Union Manufacturing Company, New Britain, Conn., manufacturer of lathe and drill chucks, etc., will build a two-story addition to its factory and also a boiler house.

The contract has been let for the erection of a new garage for Richard J. Dillon, Hartford, Conn. The basement will contain the boiler room and cold-storage room. L. D. Bailey, architect.

The M. B. Hill Manufacturing Company, Worcester, Mass., manufacturer of milling machines and lathe dogs, has sold its plant to the Ready Tool Company, Bridgeport, Conn., which will move the plant there.

The Anglo-American Textile Company, to be located in Pawtucket, R. I., has been incorporated with $100,000 to engage in a general textile machinery business. W. A. Spicer, H. W. Thatcher and H. J. Humphrey are incorporators.

MIDDLE STATES

The Detroit (Mich.) Insulated Wire Company is erecting a new factory.

The Keeler Brass Company, Grand Rapids, Mich., is erecting a two-story addition.

The Lake Shore railroad will erect a large roundhouse and shops at Toledo, Ohio.

The Eddy Auto Company wil build a garage at May and Oak streets, Cincinnati, Ohio.

Morris Machine Works, Baldwinsville, N. Y., is planning large addition to its machine shop.

The Toledo Spring and Mattress Company, of Toledo, Ohio, is erecting an addition to its plant.

The Ohio Machine and Boiler Company, Cleveland, Ohio, will make additions to its factory.

The Cleveland Pneumatic Tool Company, Cleveland, Ohio, will make additions to its factory.

The shops of the Pere Marquette Railway Company, Ionia, Mich., will be considerably enlarged.

Chase Motor Truck Company, Syracuse, N. Y., is building addition for assembling and painting.

The Chesapeake & Ohio railroad is to erect new roundhouses, yards and planing mill at Silver Grove, Ky.

The Southern Railway will build an 18-stall roundhouse and establish a repair plant at East St. Louis.

The Citizens Motor Car Company will build an addition to its garage at Seventh and Main streets, Cincinnati, Ohio.

Wendel & Smith have let contract for a garage at Fifty-eighth street and Woodbine avenue, Philadelphia, Penn.

A three-story garage to cost $11,600, will be built for A. B. Price, at 3431 Ludlow street, Philadelphia, Penn.

The River Furnace Company, Cleveland, Ohio, contemplates building a large steel plant. A site has been purchased.

The Illinois Steel Company, Eighty-ninth street and Strand avenue, Chicago, Ill., will build a one-story addition to its plant.

A permit has been issued to Smith, Drum & Co. for machine-shop additions at Firth street, east of Coral, Philadelphia, Penn.

Stewart & Clark Manufacturing Company, making speedometers, has bought site adjoining its property on Wolfram street, Chicago.

The F. B. Stearns Automobile Company, Cleveland, Ohio, plan on the entire rebuilding of its plant. New machinery will be needed.

The C. E. Squires Company, manufacturer of steam specialties, Kelley and East Fortieth street, Cleveland, Ohio, is erecting an addition.

C. Arthur Benjamin, Inc., Syracuse, N. Y., is planning for new and large garage for storing and repairing in all branches of auto work.

The Chicago (Ill.) Steel Foundry Company will erect a new foundry building and pattern shop at Kedzie avenue and Thirty-seventh street.

The Western Brass Manufacturing Company will build a three-story shop and warehouse at 2005-11 Marshall boulevard, Chicago, Ill.

A garage to cost $10,000 will be erected for Eareckson, Hoffacker & Fleming, on Chestnut street, west of Forty-eighth street, Philadelphia, Penn.

The Cyclone Wire Fence Manufacturing Company, East Fifty-fifth street, Cleveland, Ohio, will make large additions to its factory and equipment.

A new factory will be built by the Standard Manufacturing Company, makers of plumbers' supplies, at Cleveland, Ohio, just as soon as site is secured.

The Chicago (Ill.) Railways Company will build a one-story machine shop at 2513-17 Armitage avenue, Chicago, and will fit it up with new tools.

The Chicago, Rock Island & Pacific railroad is erecting a two-story repair shop at 140 West Fifty-first street, Chicago, Ill., and will install new tools.

The Little Motor Car Company, of Flint, Mich., has been incorporated to manufacture motor cars. W. H. Little, C. M. Begole, principal stockholders.

The Campbel-Wayant-Cannon Foundry Company, Muskegon Heights, Mich., will erect an addition to its foundry. The concern makes motor castings, etc.

The White Automobile Company, Cleveland, Ohio, will build a large addition to its plant. Geo. H. Smith is the architect. New machinery will be installed.

The Illinois Central railroad will build a one-story brick addition to its engine room at Burnside West Ninety-fifth street and Cottage Grove avenue, Chicago.

The Phipps-Grinnel Company's plant, manufacturer of electric pleasure vehicles at Detroit, Mich., was partially destroyed by fire. Will be rebuilt at once.

The Chicagfo (Ill.) Iron Foundry Company has purchased a two-story brick building at Austin and Claremont avenues, and will remodel the same for its business.

The Fischer Motor Car Company, Cincinnati, Ohio, has leased 15,000 square feet of floor space at 904 to 808 Sycamore street and will operate a commercial garage.

The recently incorporated Ideal Wrapping Machine Company, of Middletown, N. Y., has purchased a site on which it will erect a factory to make wrapping machines.

The Toledo Metal Spinning Company, Toledo, Ohio, has been organized to manufacture all kinds of metal articles by Geo. H. Labor, Walter R. Ewing, Chas. E. Holt, etc.

Perfume Vender Company, Chicago, Ill., has been incorporated to manufacture perfume mechanical devices by Nathan Buckman, Chas. Stineberg, Bernard S. Field. Capital, $10,000.

The Sibley Stove Company has been incorporated at South Bend, Ind., to manufacture stoves, etc. Capital, $50,000. Directors, I. A. Sibley, H. G. Green and N. C. Sprague.

The Wabash Gear Works, Terre Haute, Ind., is considering the establishment of a branch manufacturing plant at Winchester, Ind. The new factory is to manufacture automobile parts.

The Burkett Lightning Rod Company, Fremont, Ohio, has been organized with a capital of $20,000 to manufacture lightning rods by W. S. Burkett, O. J. Burkett, O. V. Burkett, etc.

American Vacuum Cleaner Company, Chicago, Ill., has been organized with $5000 capital to manufacture vacuum cleaners by Bernard J. Brown, Garsfield Collins, Frank Navigato.

The Waite-Hayden Company, Syracuse, N. Y., has been incorporated with $10,000 capital to manufacture watchman's and time clocks. Incorporators, W. M. Waite, P. B. Hayden, etc.

The Ignition Starter Company, of Grand Rapids, Mich., manufacturer of Disco self-starter for automobiles, has moved its plant to Detroit, Mich., where it will greatly increase its output.

The Western Supply and Wrecking Company, of Bluffton, Ind., has been incorporated with $35,000 capital to conduct a machine shop. Directors, J. F. Harris, T. R. Hoskins and Thomas Flynn.

The Letz Manufacturing Company, Crown Point, Ind., has been incorporated with a capital of $20,000 by Gerge, Otto E., John and William Holland-Letz, to manufacture feed-grinding machinery.

The Tuber Manufacturing Company, Barberton, Ohio, has been organized with $10,000 capital to manufacture all kinds of farming machinery by Jerome Snyder, John H. Swisher, J. C. Burtner, etc.

The Modern Specialties Manufacturing Company, Goshen, Ind., has been incorporated with a capital of $25,000 by C. C. Tiedemann, John Winter, E. E. Ash and J. A. Snapp to manufacture machinery.

The Vilter Manufacturing Company, Milwaukee, Wis., has secured a permit to erect a factory on Clinton street and Kinnickinnic avenue. The concern builds Corliss engines and ice-making machines.

The New Tool Company, Cleveland, Ohio, has been incorporated with $5000 capital to manufacture machine tools, etc. The firm is looking for a factory building. Office, 44 Wade building, Cleveland, Ohio.

The Portsmouth Automobile Company, Portsmouth, Ohio, has been incorporated to do a general repair and garage business. Incorporators, Lincoln Poole, Walter E. Ruhlman, etc. Capital, $10,000.

The Multi-Color Attachment Company, Cincinnati, Ohio, has been incorporated to manufacture attachments for printing presses by John H. Miller, John L. Shuff, Albert Winkleman, etc. Capital, $10,000.

The Burke Machine Tool Company, Conneaut, Ohio, has been incorporated with $20,000 capital to manufacture and deal in machinery of all kinds by G. H. Burke, Floy A. Burke, A. P. Claude, etc.

The Western Steel Car and Foundry Company, One Hundred and Thirty-sixth street and Howard avenue, Chicago, Ill., has commenced the erection of a two-story shop and office, and will add new tools.

The Muhle Motor Car Company, Cincinnati, Ohio, has been organized to do a general motor-car business including a repair shop by Henry M. N. Muhle, John C. Miller, Henry Smith, etc. Capital, $25,000.

The Rust Proof Roller Window Screen Company, Clyde, Ohio, has been incorporated to manufacture a roller window screen by J. Harmon Baynes, A. D. BeVier, Harriet E. Baynes, etc. Capital, $10,000.

The Horton Basket Machine Works, Fourth and Magee streets, Elmira, N. Y., is rebuilding its plant partly destroyed by fire some time ago. The new plant will be larger and mill supplies manufactured in addition.

Dayton Turbine Pump Company, Dayton, Ohio, has been incorporated with $100,000 capital to manufacture and deal in pumps of all kinds by Edward R. Kirby, Samuel B. Thompson, Arthur A. Stevens, etc.

The Xcelda Specialties Company, Cleveland, Ohio, has been incorporated to manufacture and deal in hardware specialties of all kinds by Harry E. Davis, W. H. Hasselman, Joseph A. Shipley, etc. Capital, $15,000.

The Modern Vending Machine Company, New York, has been organized to make vending machines, etc. Capital, $80,000. Incorporators, Jas. D. Ferris, 306 West Fourth street; M. A. Lesser, 302 Broadway, etc.

The International Motor Service Association, New York, has been incorporated to manufacture automobiles, motor vehicles, etc. Capital, $100,000. Incorporators, Wm. H. Brearley, W. W. Friend, of 25 Broad street, etc.

The Finlay Auto Company, Brooklyn, N. Y., has been incorporated with $10,000 capital to conduct an automobile and garage business. Incorporators, Wm. Finlay, Jos. Scholl, Ernest Finlay, 91 Kingston avenue, Brooklyn, N. Y.

The Gallagher-Tompkins Company, New York, has been organized with $175,000 capital to manufacture engines, machinery, etc. Incorporators, F. B. Tompkins, 66 Broadway; R. W. Galligher, 609 West One Hundred and Fourteenth street, etc.

SOUTHERN STATES

The Peninsula Automobile and Garage Company, Newport News, Va., has awarded contract for the erection of a garage and repair shop.

WEST OF THE MISSISSIPPI

The Standard Iron Works, San Diego, Cal., has taken out a permit to build an addition to its plant.

The roundhouse of the Union Pacific Railroad, at Sidney, Neb., was destroyed by fire. Loss, $250,000.

Fame Wethern, Figueroa street, Los Angeles, Cal., has taken out a permit to build a machine shop.

The garage and machine shop of Pilkington & Sons, Roseburg, Ore., was destroyed by fire. Loss, about $25,000.

The Imperator-Quilp Mining Company, Republic, Wash., will build a new machine shop and blacksmith shop.

The California Pipe and Steel Company, Los Angeles, Cal., has taken out a permit to build an addition to its plant.

H. L. Camp & Co., Portland, Ore., will build a commercial garage and repair plant on East Sixteenth street.

The Los Angeles (Cal.) Railway Company has taken out a permit to erect a new repair shop on San Pedro and Sixteenth streets.

The Llewellyn Iron Works, Seattle, Wash., has leased property at Vancouver, Wash., and will establish a branch iron-working shop.

The Union Well Supply Company, Los Angeles, Cal., manufacturer of oil-working machinery, will build an addition to its plant.

N. H. Knoll, Los Angeles, Cal., has leased property on West Washington street, and will establish a commercial garage and repair shop.

The commercial garage and blacksmith shop of J. H. Ogle, La Grande, near Fresno, Cal., was destroyed by fire. The plant will be rebuilt.

The E. L. Rogers' Garage Company, Colton, Cal., will establish a new commercial garage and repair plant on Ninth and I streets.

Lamb & Randall, Wenatchee, Wash., contemplate the erection of a foundry plant at Wenatchee. Modern equipment will be installed.

The Dorris Motor Car Company, St. Louis, Mo., has taken out a permit for the construction of first units of its new addition to cost $68,000.

McIntyre & Dysert, San Bernardino, Cal., plan for the erection of a commercial garage and repair plant. Modern equipment will be installed.

The Benoist Aircraft Company, 6664 Delmar avenue, St. Louis, Mo., will build a new plant near Kinloch park, to replace the one recently burned.

Herbert Gartin, Ellensburg, Wash., is having plans prepared for a large commercial garage and repair plant. Modern machinery will be installed.

The commercial garage and repair plant of the Rudy automobile garage, East Twenty-First street, Portland, Ore., was completely destroyed by fire.

The Bates & Moore Company, Los Angeles, Cal., has acquired property on Lacy street, and will establish a large commercial garage and machine shop.

W. A. Kempster, Los Angeles, Cal., has leased property on East Eighth street, and will establish a plant for the manufacture of electrical fixtures.

The roundhouse of the Las Vegas & Tonopah Railway, Goldfield, Nev., was wrecked by the explosion of a locomotive boiler. The plant will be rebuilt.

The Studebaker Company, Los Angeles, Cal., automobile dealers, has acquired property on East Seventh street, and will establish a commercial garage.

The Oregon Power Company, Eugene, Ore., plans for the erection of a garage for the care and repair of its automobiles. Modern equipment will be installed.

The machine shop of Hathaway Brothers, Corvallis, Ore., was destroyed by fire. The plant will be rebuilt and new machinery purchased. About $6000 will be expended.

J. W. Leavitt & Co., Los Angeles, Cal., representing the Overland automobile, has leased property on South Olive street, and will establish a commercial garage and repair plant.

CANADA

The Dominion Axle and Forge Works, a new concern, has begun the erection of its new factory at Guelph, Canada.

The Alaska Industrial Company, Prince of Wales Island, Alaska, will build a new blacksmith shop at its mining property.

GENERAL MANUFACTURING

NEW ENGLAND

John J. Folsom is erecting a sawmill at Foxcroft, Me.

E. W. Beech, of Lincoln, Me., is to erect a large planing mill.

A new pumping station is to be erected on the Boulevard, at Lowell, Mass.

D. Whiting & Sons Company is erecting a large creamery at Foxcroft, Me.

Quincy, Mass., will issue $10,000 bonds for improvements to its water system.

Littleton, Mass., will issue $30,000 bonds for improvements to its waterworks system.

The Clinton (Mass.) Wire Cloth Company is to make large additions to its power house.

The Connecticut Company is to erect an addition to its power house at Bridgeport, Conn.

The C. J. O'Keefe Shoe Company, Haverhill, Mass., is to remove its plant to Marlboro, Mass.

The Derby Gas Company, Bridgeport (Conn.) is to erect three large additions to its present plant.

The American Marble Company will rebuild its plant at Fair Haven, Vt., recently burned, with a loss of $12,000.

Work has been started on a boiler house to be erected for W. F. Brandegee on George street, Bridgeport, Conn.

The factory of the Delchery Hat Company, Danbury, Conn., was partly destroyed by fire, causing a loss of $75,000.

The Boston & Albany railroad will construct a new pumping station for its water supply, near Palmer, Mass.

Ralph L. Wadsworth & Co., Northboro, Mass., will install two new boilers in its buildings on Pleasant street.

A glue factory, at Eastport, Me., owned by the Lane-Libby Fish Company, of Vinal Haven, Me., was destroyed by fire.

The Bottom & Torrance Company, collar and cuff manufacturer, of Burlington, Vt., are to remove its plant to North Adams, Mass.

The New Bedford (Mass.) Textile Company, manufacturer of cotton banding, is to erect a two-story addition to its present plant.

Work has been started on an addition to the laundry and boiler house of Lowe & Welch on Stratford avenue, Bridgeport, Conn.

Fred. W. Stuart has purchased land on Congress street, Beverly, Mass., and will erect a modern plant for the manufacture of last blocks.

W. S. Gamage, Worcester, Mass., has secured the old shoe factory in Westboro, Mass., and will equip same for the manufacture of carriages.

The Rice & Hutchins Shoe Company, Marlboro, Mass., will convert the old Middlesex factory into a plant for the manufacture of paper boxes.

The Brockton Gas Light Company, Brockton, Mass., will issue $250,000 additional stock, part of which will be used for enlarging its plant.

The gas-supply plant of the New Departure Manufacturing Company, Bristol, Conn., which is used for motive power, will be overhauled and renovated.

The Central Maine Power Company has begun work on a new electric-lighting plant at Corrina, Me., to take the place of that destroyed by fire.

The Elmville (Conn.) Worsted Company, capitalized at $10,000, will open a plant in that town. F. E. Holden, of Woonsocket, R. I., is president.

A new shop for the manufacture of paper boxes is being erected for the J. C. Clogson Company, in Lexington avenue, near Grand, Fair Haven, Conn.

Matthew J. Whittall, Worcester, Mass., will erect a cold-storage plant at Pakachoag road and Brussels street. It will be equipped with modern appliances.

The American Wood Working Company, Berlin, N. H., has acquired a plant in that town and will equip same for the manufacture of spools, bobbins, etc.

J. B. Tatem & Son, West Thompson, Conn., manufacturers of handles and picker sticks, have purchased the Arnold property in Putnam, Conn., and will move its plant there in the near future.

Fitchburg, Mass., contemplates installing several electric motors in its schools to take the place of water motors in use at the present time for the ventilating systems. The finance committee has charge.

The C. J. O'Keefe Shoe Company, Haverhill, Mass., contemplates the removal of its plant to Marlboro, Mass. A factory has been secured and the company intends to increase its capacity about 50 per cent.

The Bay State Talc Company, North Adams, Mass., has incorporated with $150,000 capital to erect a mill and mine talc on land near the Hoosac tunnel. Isaac M. Williams, president; B. K. Shoffer, New York, secretary and treasurer.

The Central New Hampshire Power Company, Brattleboro, Vt., has incorporated with $15,000,000 capital to erect dams and hydro-electric power plants for furnishing power to manufacturing plants in New Hampshire and Massachusetts.

The Rhode Island Absorbent Cotton Company has been incorporated for $100,000 for purpose of engaging in manufacturing of bleaching, dyeing, spinning and dealing in cotton and other products. The concern will be located in Providence, R. I.

MIDDLE STATES

Binghamton, N. Y., has voted to establish a municipal lighting plant.

The Muncie (Ind.) Ice Company is building an addition to its plant.

Fire destroyed the cooperage shop of Henry Wolfe, Evansville, Ind.

The Globe Woolen Company, Utica, N. Y., is erecting a new boiler house.

The Cannelton (Ind.) Chair Company's plant has been destroyed by fire.

The Illinois Watch Company, Springfield, Ill., is planning to erect a $10,000 addition.

The Buckey Candy Company, Toledo, Ohio, is in the market for candy-making machinery.

Ressigue & Partridge's glove factory at Northville, N. Y., was burned. Loss, $17,000.

The factory of the Lewisburg Chair Company, of Lewisburg, Penn., was destroyed by fire.

The Clark Brothers Pottery Company, Crooksville, Ohio, will build additions to its plant.

The Syracuse Rendering Company is erecting a large addition to its plant at Syracuse, N. Y.

The Weinert & Nurin Baking Company, Dayton, Ohio, will erect a new plant on Dale avenue.

The Detroit (Mich.) Excelsior Company, manufacturer of excelsior, is erecting a new factory.

The Standard Furniture Company, Herkimer, N. Y., is erecting an addition to its factory.

The Blabon Oilcloth Works, Philadelphia, Penn., was partly destroyed by fire. Loss, $75,000.

The Crown Chemical Company, 311 East South street, Indianapolis, Ind., will install a boiler.

Hannibald Furniture Company will build a new factory at 1919-21 Sheffield avenue, Chicago, Ill.

Fire destroyed the tannery of the Ashland Leather Company, Ashland, Ohio. Loss, $125,000.

The Johnston Glass Company, Hartford City, Ind., is adding a bent-glass department to its plant.

C. W. Kotcher, Detroit, Mich., manufacturing sash and doors, is erecting an addition to his plant.

A new mill and carpenter shop will be erected and equipped by H. A. Harris, at Cleveland, Ohio.

Fire destroyed the laundry of the New York City Tuberculosis Sanitarium, at Otisville, N. Y. Loss, $6000.

The plant of the Crystal Flake Salt Company, of Marine City, Mich., was destroyed by fire on October 30.

Fire destroyed the factory of the Pittsburgh Plate Glass Company, at Court and Broadway, Cincinnati, Ohio.

The Ryan & Donlin grain elevator, at Delphi, Ind., was wrecked by a derailed freight train. Loss, $15,000.

The McGraw Plaster Company, of Detroit, Mich., making ornamental plaster goods, is to erect a new factory.

The United States Paper Company, Cincinnati, Ohio, has plans for a new factory to be erected on Pearl street.

Salamanca (N. Y.) Furniture Company will build a four-story brick building which will double the plant's capacity.

Plans are being prepared for a large addition to be erected to the Franklin Brewing Company, of Columbus, Ohio.

The Wabash Mutual Telephone Company, Wabash, Ohio, just incorporated, will want telephone equipment. A. W. Lurne is manager.

The Spreckles Sugar Refinery is erecting an addition to its plant at Swanson and Dickinson streets, Philadelphia, Penn., to cost $50,000.

The glue plant of the Suizberger & Son Company, in the Union stock yards, at Chicago, Ill., was damaged by fire. Loss, about $35,000.

A permit has been granted for an addition to the power house of the Pennsylvania Railroad Company, at Holmesburg Junction, N. J., division.

The Rochester, Syracuse & Eastern Railroad Company will spend about $40,000 altering and improving its pumping-station facilities at Lyons, N. Y.

The Howell-Hinchman Company, Middletown, N. Y., has awarded the contract for a two-story addition to its tannery for the japanning department.

The Schemm Brewing Company, Saginaw, Mich., will erect a two-story building at Miller and Hamilton streets to be used for bottling department.

The John W. Brown Manufacturing Company, Columbus, Ohio, making auto and carriage lamps, is having plans prepared for an addition to its plant.

The Central Manufacturing Company, Lockland, Ohio, manufacturer of grease and fertilizers, will build an addition to its plant. G. W. Drach, architect.

A factory will be built and equipped fully, for the manufacture of interior and exterior finish, by Herman Harris, building contractor, at Cleveland, Ohio.

The Lewisburg Lighting Company, of Lewisburg, Ohio, has been incorporated to furnish light and power in Lewisburg and vicinity by D. S. Gaskill.

The Quaker City Lace Company has purchased three factory buildings at Fourth street and Lehigh avenue, Philadelphia, Penn., to use as a lace-manufacturing plant.

The Security Reliner Company, a recently incorporated concern, is considreing the erection of a factory at Montgomery, N. Y., for the manufacture of automobile tires.

The carriage and wagon works of Garrett & Son, at Thirty-ninth and Spring Garden streets, Philadelphia, Penn., was partly destroyed by fire. Loss, $20,000. Will rebuild at once.

The Kehoe Light and Power Company, Fort Wayne, Ind., has been incorporated with a capital of $100,000 by T. J. Kehoe, C. F. Riedel and others, to manufacture and sell electricity.

The Lewisburg Lighting Company, Lewisburg, Ohio, has been formed with $5000 capital to manufacture and transmit electric current by D. L. Gaskill, A. C. Robeson, J. M. Bickel, etc.

Ransbottom Brothers Pottery Company, Roseville, Ohio, will immediately build a three-story addition to its pottery. A 150-horsepower engine, 300-horsepower boilers will be installed.

The Beebe Cordage Manufacturing Company, Rockaway, N. Y., has been incorporated to manufacture yarn, mops, etc. Capital, $50,000. Incorporators, C. and N. A. Beebe, E. L. and E. H. Todd.

The David H. Schmidt Company, piano hammer manufacturer, in Bronx borough, New York City, has secured a factory building in Poughkeepsie, N. Y., which it will have ready for business next spring.

The Diagonal Block Tire Company, Akron, Ohio, has been incorporated to manufacture rubber autmobile tires and rubber articles by J. A. Swinehart, W. R. Talbot, Frank R. Talbot, etc. Capital, $25,000.

The Canton Porcelain Company, Canton, Ohio, has been organized to manufacture brick, tile and other earthen products by Fred A. Fenton, Edward Williams, Martin P. Lambert, etc. Capital, $25,000.

The Toledo Sugar Company, Toledo, Ohio, has been incorporated with $1,000,000 capital to operate refineries for the manufacture of sugar by James E. Larrowe, Joseph F. Kilby, Richard S. Woodrow, etc.

The Centerburg Water Company, Centerburg, Ohio, has been organized with $25,000 capital to build and operate a waterworks system. Incorporators, G. M. Cummings, W. L. David, John M. Garfield, etc.

The plant of the Platteville (Wis.) Separating Works was destroyed by fire. The plant was owned by the American Lead and Zinc Company, and used for reducing low-grade ore. The plant will probably be rebuilt.

The Interstate Chemical Corporation of Virginia, recently formed, will build fertilizer factories immediately at Charlotte, N. C., and Macon, Ga. J. S. Williams, Richmond, Va., is vice-president, and C. S. Bryan, of New York, is treasurer.

The Helwig Silk Dyeing Company, of Philadelphia, has purchased a six-acre tract of land at Lardners Point, Penn., on which it will erect a group of factory buildings to increase the capacity of its present plant. Estimated cost, $250,000.

SOUTHERN STATES

Heckle & Kellogg, Cape Charles, Va., will erect a cold-storage plant.

The Macon (Ga.) Cooperage Company will erect an addition to its plant.

The Chesapeake & Ohio railroad has secured a permit for the erection of a power house in Covington, Ky.

The Quality Shirt Manufacturing Company will equip a large factory at 2 and 4 Hanover street, Baltimore, Md.

The plant of the Milton-Peter Manufacturing Company, Louisville, Ky., recently destroyed by fire, will be rebuilt. The concern manufactures tables.

Plans for a large factory and warehouse for Hirschberg, Holander & Co., are being prepared in Baltimore, Md. The new factory will be erected at Warner and Ostend streets, and will be equipped for the manufacture of paints.

WEST OF THE MISSISSIPPI

T. B. French, Corcoran, Cal., will build a modern creamery plant.

Grafton, Stave & Heading, Biggers, Ark., are to install a new boiler.

Nogales, Ariz., will issue $120,000 bonds for improvements to its waterworks system.

C. C. Ross, Goldendale, Wash., plans for the erection of a modern ice-manufacturing plant.

Lamar, Mo., voted $70,000 bonds for the construction of municipal light and power plant.

The concentrator of the Butte Reduction Works, of Butte, Mont., was destroyed by fire. Loss, $300,000.

The Standard Oil Company will install new pumping machinery at its station at Maltby, near Martinez, Cal.

Rueter Hub and Spoke factory is considering the purchase of some new lathes for its plant at Dexter, Mo.

The Maricopa (Cal.) Thirty-six Oil Company contemplates the instalation of new oil-drilling machinery.

The shingle-mill plant of W. Knagg, Kent, Wash., was destroyed by fire. It is said the plant will be rebuilt.

The sawmill plant of the Home Lumber Company, Bishop, Cal., was destroyed by fire. The plant will be rebuilt.

W. F. Calvert, Riverside, Wash., plans for the erection of an electric-lighting plant to serve Riverside and vicinity.

The lumber plant of the Chehalis Lumber Company, Littell, Wash., was destroyed by fire. Loss, estimated at $200,000.

The Charles McCormick Lumber Company, Los Angeles, Cal., will build a new lumber plant at San Bernardino, Cal.

The Pelican Bay Lumber Company, Klamath Falls, Ore., plans for the erection of a large box-manufacturing plant.

The Dover Oil Company, Hinkley, near Barstow, Cal., will install oil-drilling machinery for operation of its properties.

The G. M. Simpson Lumber Company, Alhambra, Cal., has taken out a permit to build an addition to its lumber plant.

The National Union Oil Company, San Diego, Cal., has taken out a permit to build a boiler-room addition to its plant.

Jessel Cohn, Chicago, Ill., is said to be planning for the erection of a plant for the manufacture of shoes, at San Jose, Cal.

H. W. Harpster, Los Angeles, Cal., has acquired property at Techachapi, Cal., and plans for the installation of a pumping plant.

John Morrell & Co., Spokane, Wash., plans for the erection of a modern cold-storage plant. About $20,000 will be expended.

The city of Jacksonville, Ore., has voted bonds for the installation of a waterworks system. About $30,000 will be expended.

The Sparr Fruit Company, Fillmore, Cal., will build an addition to its fruit-packing plant. Modern equipment will be installed.

E. J. Stanton, Los Angeles, Cal., has acquired property on Alameda street, and plans for the erection of a hardwood milling plant.

The sawmil plant of the Merrick & Robb Lumber Company, Arline, Wash., was destroyed by fire. Loss estimated at $35,000.

The California Northern Telephone and Telegraph Company, Quincy, Cal., plans for the erection of an exchange plant at Greenville, Cal.

The Pacific Telephone and Telegraph Company, San Francisco, Cal., plans for improvements and additions in its system at Dinuba, Cal.

The Globe (Ariz.) Water and Irrigation Company plans to install new air-compressor equipment at its property near San Simon, Ariz.

The Gate City Laundry, San Bernardino, Cal., is having plans prepared for a new laundry plant. Modern equipment will be installed.

The Palace Laundry Company, Portland, Ore., has taken out a permit to build a new laundry plant. Modern machinery will be installed.

The Pacific Telephone and Telegraph Company, Portland, Ore., plans for extensions and improvements in its plant and system at Odessa, Wash.

The Guy M. Rush Company, Los Angeles, Cal., plans for the erection of a large pumping plant on property recently acquired near Riverbank, Cal.

L. J. Sweet, Los Angeles, Cal., plans for the erection of a steam-laundry plant at Inglewood, near Los Angeles. Modern equipment will be installed.

The San Joaquin Light and Power Company, Fresno, Cal., contemplates the installation of electric pumping machinery in the Caruthers district.

C. P. Bowman, Stanfield, Ore., plans for the installation of a telephone exchange and system at Stanfield and vicinity. A franchise has been granted.

The Central Colorado Power Company, Leadville, Colo., plans for the installation of two large electric pumping plants in the Fryer Hill district.

L. C. Leach, Terminal, Cal., has acquired property at Richgrove, Tulare county, Cal., and contemplates the installation of two modern pumping plants.

The city of Provo, Utah, plans for extensive improvements and additions in its waterworks system. Elmer Jacobs, engineer, is in charge of this work.

The Independent Brewing Company, Seattle, Wash., will make improvements and additions in its plant on Ninth avenue. New equipment will be installed.

William H. McGoldric, Corvallis, Ore., plans for the erection of a gas-manufacturing plant and electric power plant, at Corvallis. Franchises have been asked.

The Growers' Fruit Company, Olive, Cal., has acquired a site and will erect a modern fruit-packing plant. The plant will be fully equipped with machinery.

The Centennial Telephone Company, Astoria, Ore., will install a telephone plant and system from Astoria to the Nehalem valley. A franchise has been granted.

The Crown Point Gold and Silver Mining Company, near Goldfield, Nev., plans to install new pumping machinery. W. C. Peay is interested in this property.

The Union Cooperage Company, Aberdeen, Wash., has been reorganized. The present plant will be remodeled into a shingle mill and new machinery installed.

The C. M. Wooster Company, Los Angeles, Cal., contemplates the installation of a number of pumping plants, near Carrizal, Mex. Charles P. Rogers is manager.

The Riddle (Ore.) Development League plans for the erection of an electric-lighting plant in the Umpqua valley, with a distributing system to adjacent sections.

The Tonawanda Placer Company, near Wickenburg, Ariz., will install a modern waterworks system on its mining properties. About $75,000 will be expended.

The Mountain States Telephone and Telegraph Company, Salt Lake City, Utah, plans for the construction of a telephone system from Twin Falls, Ida., to Rogerson.

The Arrowhead Reservoir and Power Company, Barstow, Cal., has acquired a water site on the Mohave river and plans for the erection of an electric power plant.

The Tenino (Wash.) Stone Company contemplates the erection of a stone-grinding and finishing plant, near Vancouver, B. C. D. F. Russell is manager of this company.

The clam-canning plant of the Quinault Packing Company, Copalis, Wash., recently destroyed by fire with a loss of about $25,000, will be rebuilt. F. A. Turner is manager.

The Portland Irrigation Company, Lakeview, Ore., plans to install pumping plants and irrigation system in the Chewaucam river district. About $50,000 will be expended.

The city of Bellingham, Wash., plans for improvements and additions in its waterworks plant. About $50,000 will be expended. H. A. Whitney, city engineer, is in charge.

The city of Cornelius, Ore., plans for the installation of a waterworks system. About $20,000 will be expended. Stannard & Richardson, engineers, Portland, Ore., are preparing plans.

The Pacific Power and Light Company, Portland, Ore., has acquired the plant of the Dayton (Wash.) Electric Company. Improvements and additions will be made in the plant and system.

The Home Telephone Company, Los Angeles, Cal., has taken out a permit to build an addition to its exchange substation on Forty-fifth street. The company also plans for the erection of a new exchange plant at Rialto, Cal.

The Southern Sierra Power Company, Riverside, Cal., contemplates the erection of a steam power plant at Banning, Cal. The company has been granted a franchise at Perris, Cl., and will install an electric-light and power system.

The American Safety Powder Company, Portland, Ore., has acquired property at Astoria, Ore., and plans for the erection of a plant for the manufacture of powder and kindred specialties. A. W. Hendricks is head of this company.

The Northern California Power Company, Sacramento, Cal., plans for the erection of a large power plant on the Pitt river, with a total generating capacity of 120,000 horsepower. A steel tower transmission system will be installed in the Sacramento valley. The entire work is estimated to cost $400,000. E. V. D. Johnson is general manager.

The Palomas Highland Water Users' Association, Phœnix, Ariz., recently organized, plans for the installation of a 50,000-gallon pumping plant on the Gila river, near Agua Caliente. The company also plans for the erection of a crude-oil, gas-generating plant near Sentinel, Ariz. J. E. Nelson and W. P. McNealy are interested in this organization.

CANADA

Gate valves for water system are required at Point Grey, B. C. Municipal clerk, H. G. Floyd.

Joseph Dent, of Thamesville, Canada, is planning to build a new sawmill at Dutton, Canada.

Neepawa, Canada, is asking for bids for a waterworks system. J. W. Bradley, secretary-treasurer.

Ridgetown, Canada, will require a gasolene engine and a producer-gas engine for its new waterworks system. Consulting engineer, C. E. Farncombe, London, Canada.

MINING

The Nabob mine, near Wardner, Ida., plans for the erection of a milling plant.

A. E. Kelso, Cripple Creek, Colo., plans for the erection of a 100-ton cyanide plant.

The Oro Colorado mine, Cananea district, Mex., will install a stamp mill and cyanide plant.

S. W. Steffner and I. P. Carpenter, Manhattan, Nev., plan for the erection of a milling plant.

The United States Navy mine, Copper Basin district, Ariz., will build a new milling plant.

The Coronado Gold Mining Company, near Congress, Ariz., plans for the erection of a 20-stamp mill.

The Knob Hill Mining Company, Republic, Wash., contemplates the erection of a 100-ton smelting plant.

The Fort Bidwell Consolidated Mining Company, Hoag district, Cal., will increase the capacity of its stamp mill.

The Kate Hardy mine, Forest (Sierra county), Cal., will increase the capacity of its milling plant early in 1912.

The Silver King Mining Company, Elkhorn district, near Gates, Ore., plans for the erection of an electric smelting plant.

The Marshall Lake Mining Company, Lewiston, Ida., plans for the erection of a milling plant. E. B. Wiggin is manager.

The Valdez (Alaska) Gold Milling Company, recently organized, plans for the erection of a stamp mill and ore-treating plant.

The North Star Mining Company, Phœnix, Ariz., plans for the erection of a milling plant. P. P. Parker is head of this company.

The Nevada-Arizona Gold Mines Company, Music Mountain district, Ariz., plans for the installation of new operating machinery.

Clarence Woods, Tuolumne, Cal., operating mining property, plans for the installation of new air compressor and hoisting machinery.

The Gemini Mining Company, Salt Lake City, Utah, plans to purchase new pumping machinery for its properties in Juab county.

The Chipas mine, Sonora, Mex., will increase the capacity of its cyanide plant. E. L. Dufourcq is general manager of this property.

The Scheuyemere Mining Company, Fairbanks, Alaska, plans for the erection of a stamp mill. W. C. Clark is president of this company.

The Cripple Creek (Colo.) Cyanide Company is said to be planning for the installation of new grinding machinery on its gold properties.

The Esmeraida-Parral Mining Company, Parral, Mex., plans to install new machinery, including boilers, hoisting machinery and air compressors.

J. B. Dunlap, Los Angeles, Cal., operating mining property, near Yuma, Ariz., contemplates the erection of a stamp mill and concentrating plant.

The Indian River Drift Mining Company, near Camptonville, Cal., plans to install a complete modern gold-washing plant. W. L. Breese is manager.

The Northwestern Smelting and Refining Company, Nampa, Ida., is having plans prepared for a large smelting plant. The work is estimated to cost $1,000,000.

The Stag Canyon Fuel Company, Dawson, N. M., plans for the installation of a modern coal-washing plant at its mines in this section. T. H. O'Brien is general manager.

The Mountain Lion mine, near Grants Pass, Ore., will make improvements and additions in its milling plant and install new concentrating machinery. C. C. Daniels is head of this property.

BUSINESS ITEMS

The International Oxygen Company has moved its New York office to 115 Broadway.

The Cincinnati Gear Company has moved to its new plant at Ninth avenue and Broadway, Cincinnati, Ohio, where increased facilities are available.

The main offices of A. Eugene Michel and staff, advertising engineers, have been moved into the Park Row building, 21 Park Row, New York, where larger space has been secured.

The Toledo Bridge and Crane Company has just completed arrangements whereby A. W. Wyckoff & Co., 2219 Farmers' Bank building, Pittsburg, Penn., will represent them in the sale of cranes in the Pittsburg district.

TRADE CATALOGS

Walworth Manufacturing Company, Boston, Mass. Circular. Stillson wrench. Illustrated.

Vulcan Crucible Steel Company, Aliquippa, Penn. Catalog. Vanadium steel. Eight pages, 5x8 inches.

Union Twist Drill Company, Athol, Mass. Catalog F. Twist drills, gear and milling cutters. Illustrated, 262 pages, 5x7 inches.

Industrial Education Book Company, Boston, Mass. Pamphlet. Smith blueprint holders and textbook holders for shop and school. Illustrated, 16 pages, 5x8 inches.

The Phosphor-Bronze Smelting Company, 2200 Washington avenue, Philadelphia, Penn. Price List No. 26. Elephant brand phosphor-bronze and other alloys. Illustrated, 32 pages, 3½x6 inches.

William A. Peck, 141-145 Brewery street, New Haven, Conn. Catalog No. 2. Nail sets, punches, combination dividers and calipers, tap and reamer wrench, etc. Illustrated; 12 pages, 6x9 inches.

FORTHCOMING MEETINGS

American Society of Mechanical Engineers, annual meeting, December 5 to 8, New York City. Calvin W. Rice, secretary, Engineering Societies building.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Sachs' standardized tool requisitions: mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, AMER. MACHINIST.

Wanted—Screw machine work; send blueprints or samples for quotations. Remington Mfg. Co., Fitchburg, Mass.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Well established concern would consider manufacturing a small patented machine on royalty. Box 1372, New Haven, Conn.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Special machinery designed and built to order; tools, jigs, fixtures, sheet metal tools and stampings. Frank J. Dyett Co., Ilion, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Wanted—To buy a small uptodate foundry and machine shop with an established business, proferably in West or South. Box 511, AMERICAN MACHINIST.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraph Company, Baltimore, Md.

I have an article with which a limited number of middle aged men with some business experience and a capital of $5000 to $7000 can start in business for themselves without endangering their capital. Address, with qualifications to Thomas A. Edison, Edison Laboratory, Orange, N. J.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CALIFORNIA

Wanted—On the Pacific coast, first-class toolmakers for experimental work; special tools, dies, etc., for small work in the typewriter class. Box 522, AMER. MACHINIST.

ILLINOIS

A Chicago manufacturer of light machinery wishes a first-class man as assistant superintendent. Box 548, AMER. MACHINIST.

INDIANA

Wanted—Practical machinist, familiar with medium and heavy machine and assembly work, to analyze drawings into operations and supervise rate setting and time study work. Box 550, AMERICAN MACHINIST.

Wanted—Man familiar with medium and heavy machine work with ability to devise best method of machining; must have a good working knowledge of the use and treatment of high-speed steel and be able to work on efficient combination of speeds, feeds and cuts. Box 551, AMERICAN MACHINIST.

MICHIGAN

Wanted—Foreman for medium sized finely equipped tool room, high-grade man thoroughly experienced on tools, dies, fixtures for electrical work, magnetos, etc., in a clean beautiful city where rent and living expenses are low; give details of experience, age and references. Box 543, AMERICAN MACHINIST.

MINNESOTA

Wanted—Experienced gasolene engine draftsman; good salary and steady employment. Apply to the Campbell Motor Co., Wayzata, Minn.

MISSOURI

Wanted—Superintendent who can invest $2000 to $3000; five-year contract. Suite 616, Commerce building, Kansas City, Mo.

NEW JERSEY

Assembler, with extensive experience on alternating- and direct-current motors and generators. Crocker-Wheeler Co., Ampere, N. J.

Wanted—By a large manufacturing company in New Jersey, a young man as assistant foreman in machine shop; good position for the right man; in applying, state age, experience and salary expected. Apply "H.," Box 552, AMERICAN MACHINIST.

Wanted — Superintendent with executive ability for a plant operating punch presses on a single line of light work; must be progressive and experienced in modern factory methods, also thoroughly familiar in details of die making and punch press operation; an unusual opportunity for the right man; give full particulars as to age, experience and salary desired. Box 553, AMERICAN MACHINIST.

NEW YORK

Wanted—Machinist on machine repairs, who is experienced in oxyacetylene welding. Otis Elevator Company, Yonkers, N. Y.

Wanted—Tool steel salesmen for all States to sell a leading brand of high-speed and carbon steels; write, giving particulars, age, salary expected, experience, territory covered, to Box 259, AMERICAN MACHINIST.

Wanted—Chief draftsman acquainted with crane and hoist construction; one who can give positive evidence of ability, can secure permanent and satisfactory position. Address Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Good opening for a few first-class mechanics to make fine interchangeable sewing machine parts by the contract; must be men of inventive ability, good habits, capable of making jigs and fixtures and improving machinery. P. O. Box 365, Philmont, N. Y.

Opening for young man in cost office of large hardware factory in central New York; technical training and some accounting experience preferred; salary not less than $650 to start; an unusual opportunity in a modern plant. Box 494, AMERICAN MACHINIST.

OHIO

Wanted—Partner with $5000, one-half interest, manufacturing new special machine; unusual safe investment; investigate. Box 556, AMERICAN MACHINIST.

A good draftsman on machine tool work; one with experience on hand and automatic turret lathes and turret lathe tools preferred; give age, experience, whether married or single, wages expected, etc. Box 540, AM. M.

Foreman for tool job in a shop manufacturing turret lathes and standard and special tools for same; do not apply unless accustomed to this class of work and the highest grade; prefer a man who has had experience in a shop manufacturing small tools for the market; give age, experience, whether married or single, wages expected, etc. Box 541, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Draftsman, experienced on condenser, evaporator, distiller and feed water work; permanent position to the right man; state age, salary and references. Box 539, AM. MACH.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

TENNESSEE

Wanted—Three or four machinists familiar with repair work in jobbing shop, $3 per day; steady work; only those familiar with working in jobbing and repair shop. Atlas Machine Co., Nashville, Tenn.

FOREIGN

Hungary, a rising market for machine tools and tools needs a local agent for efficient trading; a Budapest firm of high repute is open to take up a few first-class American agencies; references exchanged. Box 513, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

ILLINOIS

Wanted—Position as superintendent or assistant superintendent of factory; practical machinist with engineering education, wide experience in electrical, engine and general machinery manufacturing; good organizer and executive; familiar with uptodate practice and methods; at present employed; age 40; married; 12 years' successful record in previous positions; Middle West preferred. Box 478, AMERICAN MACHINIST.

INDIANA

Chief draftsman, with extensive experience on tools and fixtures and familiar with manufacture of hardware, implements and sheet metal stamping, wants a larger position. Box 542, AMERICAN MACHINIST.

MASSACHUSETTS

Designing draftsman, specialized on special automatic machinery; good references; preferred location, western Massachusetts. Box 545, AMERICAN MACHINIST.

Mechanical draftsman, designer of jigs, fixtures, special or automatic machinery, broad shop experience and good executive, desires responsible position. Box 554, AMER. MACH.

NEW JERSEY

Shop foreman, six years' factory experience in gas tip and novelty manufacturing, wishes position with opportunity for advancement; age 26; references. "Hustler," AM. M.

Mechanical engineer, graduate, 30, with eleven years' experience as erector, designer, estimator and assistant superintendent, in the line of steam power plants and machines, hoisting, conveying and general machinery, also structural work, best references, desires responsible position. Box 528, AMER. MACH.

NEW YORK

Superintendent would consider a change. Box 482, AMERICAN MACHINIST.

Mechanical draftsman wishes position; various experience. Box 558, AMER. MACH.

Experienced designer of Diesel oil engines desires position. Box 557, AMER. MACH.

Factory appraisal my specialty, ten years; finish this job November 20. Box 555, AM. M.

Designer of tools, fixture and automatic work wishes position. Box 544, AM. MACH.

As superintendent or manager with large concern, by man who has and is making good in this capacity. Box 504, AMER. MACH.

A-1 tool designer, technical graduate, wishes position; best of references; able to take charge. Box 547, AMERICAN MACHINIST.

Draftsman desires extra work designing machinery, tracings, engineering plans, patent office drawings. Box 538, AMER. MACHINIST.

Tool and diemaker, first class, can work as designer, wishes position in New York; good references. F. Ruszkouski, 165 Ave. A, New York.

Mechanical engineer, age 32, with excellent experience and record, wishes position as mill superintendent or business manager. Box 506, AMERICAN MACHINIST.

Mechanical engineer, high-grade mechanic and designer, and expert in organization, cost reduction and increase of output, desires responsible position. Box 546, AMER. MACH.

Superintendent, good organizer, now with large plant, desires to make change; 40 years old; can take complete charge of plant; wide experience in engine manufacturing. Box 537, AMERICAN MACHINIST.

Draftsman, young man, expert practical designer for automatic machinery and tools; inventive ability; capable of prosecuting patents, wishes responsible and executive position. Box 509, AMERICAN MACHINIST.

Young man, 21 years of age, desires position; fourth year at Cooper Union night school pursuing mechanical engineering; three years' experience in machine shop and three years at drafting. Box 549, AMER. MACH.

Mechanical or consulting engineer, good education, broad practical and theoretical experience, good executive, organizer and systematizer, desires executive or confidential position; would accept temporarily position as chief draftsman or designer; willing to travel. Box 521, AMERICAN MACHINIST.

The most modern methods of production and organization, increase of output and earnings, decrease of time and material, etc.; great experience as superintendent and technical manager, both in America and Europe; graduated mechanical engineer; if you are in need of such a man state work, number of men in shop and salary to Box 535, AM. MA.

PENNSYLVANIA

Experienced tool and machine designer wants position near New York. Box 483, AMERICAN MACHINIST.

Draftsman, tool designer and machinist, experienced on original design and shop management, desires position. Box 507, AM. MA.

Talks With Our Readers

By The Sales Manager

Recently the 100th anniversary of New York's famous old City Hall was celebrated.

One of the most interesting things one remembers about this noted building is that the city fathers who built it had the north side finished with brick instead of stone because they thought the building was so far up-town that no one would ever see its north side.

Now, of course, the City Hall is considered way down town. It is many miles south of the great residential sections.

What an eloquent story of American progress and growth!

Think what has happened in the metropolis, in the country, in business in the last hundred years.

And think again how much faster things have happened in the last ten or fifteen years than in all the 85 or 90 years previous.

For this greater speed of progress in recent years perhaps no one factor has been more potent than Modern Advertising.

It was advertising that made Manhattan real estate boom.

It was advertising that made New York grow beyond the census man's estimates.

It was advertising that helped to build New York's commercial supremacy.

And it is advertising that has done so much to make the machinery business one of the largest and most important in the world today.

As one employer said recently, "Show me the man who reads, intelligently, the ads in the paper about his work and I'll show you one that's a winner."

One reason why is—if advertising isn't up-to-date, progressive and helpful to the reader, it's useless. And the advertiser isn't spending his good money these days on anything that's useless.

The progressive readers of the AMERICAN MACHINIST are careful followers of the ads. They know that most of them are informative and all of them reliable.

* * *

Only reliable products can be continuously advertised.

Welding Locomotive Repair Parts

By H. W. Jacobs *

The possibilities of oxyacetylene in railroad shops, especially in welding locomotive parts.

A good system for generating and distributing the gases, installed by the Santa Fe Railroad.

Illustrations of excellent savings made by substituting the welding process for older methods of repair.

*Assistant superintendent motive power, A. T. & S. Fe railway system.

Autogenous welding, the fusing together of two pieces of metal by means of an oxyacetylene flame, is one of the most important of recent developments in the field of metal working. The combination of oxygen with acetylene produces the highest known temperature by combustion, which makes results obtainable with this flame that were formerly considered impossible; further, as the high carbon content serves to prevent the oxidizing of the metal, no flux is necessary. For these reasons, autogenous welding has a much larger field than that of any previous method. The oxyacetylene blowpipe was perfected by Fouché in 1902, but was not used in the United States until 1904, its first application being the welding of light sheets in the Fore River Ship Building Company, of Quincy, Mass.

Locomotive Repair Shops Offer Largest Field

Though railroad locomotive repair shops offer the largest individual field for autogenous welding, since it is especially suited to repair work, its installation in these shops is comparatively recent and of limited extent. In any shop where eight locomotives are undergoing repairs at one time, there is ample work to keep one man steadily employed. Innumerable locomotive parts that become either worn or cracked in service can be made serviceable by building up the worn or defective part by this process. Delay in these installations has been due to the lack of the necessary apparatus for the needs of a railroad repair shop; there was none available capable of running in excess of five hours without stopping to recharge.

Portable plants are undesirable. The shipment of oxygen at high pressures involves possible losses due to leakage, explosions, delays in shipment, and the necessary supply of extra equipment. Also there is difficulty in securing a satisfactory individual acetylene generator that will provide a steady supply of gas without variation in consistency. It is therefore necessary to have each plant in charge of a high-class workman in order to obtain satisfactory and uniform results.

Railroad shops require a generating plant centrally located, where a sufficient supply of oxygen and acetylene can be manufactured, stored under pressure and piped to points of advantage throughout the shop, because much of the work cannot be conveniently carried to a welding shop. Also, it must be safe in every respect, must comply with the requirements of the underwriters, and must be so simple that the average workman can readily handle it.

The Equipment of the Santa Fe

The motive-power department officials of the Atchison, Topeka & Santa Fé Railway realized some five years ago the enormous possibilities of oxyacetylene welding in making repairs to locomotives, and after making extensive investigations of the equipments avaliable, decided that all were too small for railroad-shop needs. On this account, a plant at Topeka was designed and built that would more nearly serve the purpose.

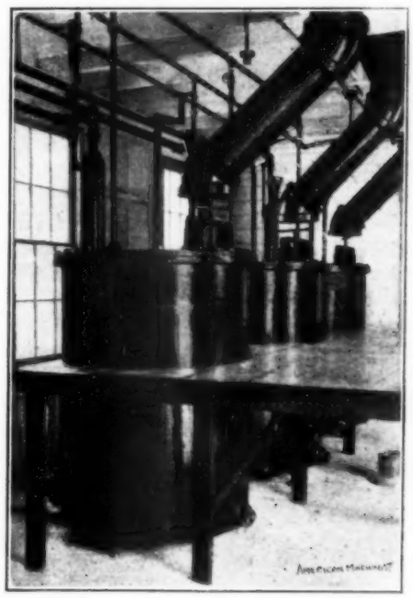


Fig. 1. Interior of Oxygen Plant

This plant, with facilities for supplying 200 cubic feet of oxygen and acetylene an hour, has been in operation for the past two years, and has proved so successful that another plant of the same general design, with a capacity of 1000 cubic feet of oxygen and an equal amount of acetylene an hour, has just been placed in operation. In these plants every effort has been made to secure maximum efficiency, and many original ideas have been incorporated in the design.

Among these new ideas is the process of generating oxygen, which is, so far as the writer has been able to ascertain, entirely new for work of this nature. The process consists of boiling in a water-tight tank a saturated solution of bleaching powder or calcium oxychloride, to which is added at regular intervals a saturated solution of iron sulphate and copper sulphate in five parts and one part, respectively. This mixture is agitated by means of a mechanically operated paddle, which facilitates the release of the gases; the oxygen passes out at the top and the residuum remains in solution, to be drawn off before the tank is discharged. The interior of the oxygen plant is shown in Fig. 1.

The sulphate solution is admitted through a pipe reaching to the bottom of the tank to insure a thorough mixture and to act at the same time as a water seal and safety valve against any excess pressure of oxygen. The water in the tank is heated by the exhaust steam from the oxygen compressor. As there are independent pipes for steam, water and the sulphate solution, the regulation is easily effected. Cast-iron pipes are used to resist the erosive action of the gas.

The oxygen passes through a dome on the top of the tank to a water scrubber, where the chlorine and all other foreign matter are recovered. The water is kept at a temperature of less than 85 degrees through a specially designed intake and outlet; a continuous stream of water passes through the scrubber and absorbs all the chlorine. The flow is so arranged as to prevent any escape of oxygen.

For final cleansing the oxygen is passed through a second scrubber filled with a solution of caustic soda. Then it passes to the gasometer, from which it is drawn out by the compressor and stored in suitable tanks at a pressure of 85 pounds. The second scrubber also serves the purpose of a water seal to the gasometer.

Generating the Acetylene

The actylene is manufactured by the usual water to carbide feed. However, the general design of the plant is unique and embodies many original ideas. Cylindrical iron cells are placed horizontally, Fig. 2, each fitted with a galvanized-iron drawer of six sections for holding the carbide. The water is admitted to each of the end sections and the gas generated is carried away in suitable pipes. When

the carbide becomes exhausted in the end cell, sufficient water has accumulated to run through a V-shaped opening in the partition to the next section; in the same manner the water enters the third section, after which the drawer is withdrawn and recharged. As a cell is opened the water supply for that particular cell is automatically closed. These generating cells are kept submerged in running water to keep the temperature of the gas as low as possible. The design is such that any cell can be inspected or recharged without interference with the operation of the others.

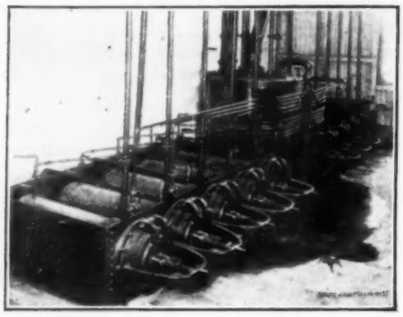


FIG. 2. THE ACETYLENE-GENERATING PLANT

An automatic control of the supply of acetylene is secured in a very ingenious manner; the two water tanks, one of which is elevated several feet, serve the double purpose of furnishing the water

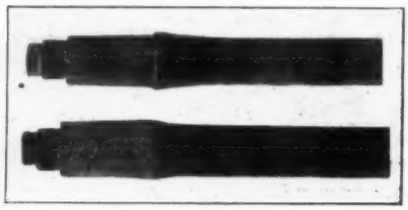


FIG. 3. PISTON-ROD RENEWAL ELIMINATED

supply and of serving as a holder for the gas generated. The acetylene is piped from the generating cells to the lower water tank. The entrance pipe extends very close to the bottom to permit the gas to be washed before it accumulates in the upper portion of the tank. Attached to this tank is a manifold that feeds the water to the generating cells through distributing pipes, the water level in the manifold being controlled by the hight of water in the tank. As the acetylene accumulates, the water level in the manifold lowers, and part of the distributing pipes become inoperative, and the number of generating cells in operation is reduced. Thus the manufacture of gas is automatically regulated.

If a supply of acetylene is generated greater than the needs of the service, the excess gas is blown out into the atmosphere, when the water level in the lower tank is so low as to expose the opening of the blowoff pipe. The gas is liberated until the reduction in pressure permits the water to rise again and seal the blowoff opening. This positive control of the acetylene supply serves to direct the attention of the operator to the excess accumulation of the gas. As the connection between the water tanks enters the lower tank near the bottom, the pressure of the acetylene depends on the distance one tank is located above the other, the present arrangement providing for a pressure of five pounds.

GENERAL FEATURES OF THE CONTROL

The design of the apparatus and the general arrangement of the generating plant are such that it can be operated by one man, and the process of generating both the oxygen and acetylene is so much simpler than any other existing method that it is unnecessary for the operator to have had any previous training. The danger usually involved in generating these gases is entirely eliminated, since the supply is automatically controlled and there is no fire used for any purpose, the steam for operating the compressor being piped from the power house. This plant gives an abundant supply of the gases at a constant pressure and eliminates all interruptions due to recharging. A sufficient stock of the necessary ingredients is kept on hand to cover any emergency, thus insuring continuous operation.

The cost of manufacturing the gas is 1.9 cents a cubic foot for oxygen and 0.7 cent for acetylene.

From the storage tanks the gases are piped to points of advantage throughout the shops. The oxygen enters the mains at a pressure of 20 pounds, controlled by a regulating valve, and the acetylene at the pressure in the tank, or five pounds, which is within the limits of underwriter regulations. Another reducing valve is placed in the oxygen line at the entrance to the shops, where the pressure is regulated, ranging from 10 pounds to 15 pounds, according to the needs of the service. This valve delivers the oxygen to the shop at the pressure to which it is adjusted, irrespective of the pressure in the mains.

In order to prevent any foreign matter from reaching the burner, the acetylene gas is passed through a filter of mineral wool or asbestos, that forms a

FIG. 4. BUILDING UP A CROSSHEAD FIT

part of the blowpipe. The filter prevents any liability of explosion from back fire.

THE BURNER

The burner or blowpipe used is of the "injector" type, in which the suction of the oxygen regulates the amount of acetylene admitted to the flame. Three styles of burners are used, one for work in a horizontal position, one for a vertical position, and a third for cutting-off work or cutting out parts of sheets; the mixture of the gases is accomplished in the same manner in the different styles. The cutting-off burner is equipped with an additional oxygen line to provide sufficient gas for satisfactory work. For the purpose of affording the operator free action in the use of the burner, rubber tubes are used to connect the blowpipes with the gas mains, the length varying according to requirements.

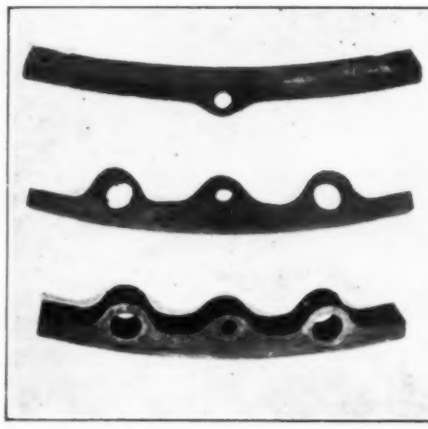


FIG. 5. LINKS ARE EASILY BUILT UP

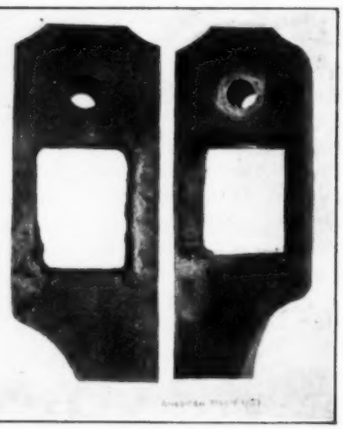


FIG. 6. REVERSE LEVER BUILT UP

Autogenous Welding a Separate Trade

The oxyacetylene method of autogenous welding is a trade separate and distinct from the established branches of metal working, though its range is so extensive as to be closely related to all. The work can be readily mastered by any ordinary workman if the education is conducted in an intelligent manner. The size and color of the flame are sufficient to enable one to readily make the proper adjustment of the gases. The main precaution to be taken by the workman is to be satisfied that the metal is thoroughly fused. Experience is a large factor and every effort is made at Topeka to enable the workmen to be thoroughly familiar with their work.

When the work was inaugurated, sample pieces were welded together and pulled apart in the testing machine; then they were returned to the workman in order that the necessary corrections could be made in the method of handling the work to insure complete success. In this manner the operators have become so expert that boiler plates ⅝ inch in thickness are welded satisfactorily. At the beginning operators are given work of minor importance until they are thoroughly acquainted with the use of the burner and have acquired some knowledge of the fusion of metals. Some have become quite skilful in a short time, even in the welding of difficult pieces.

The building-up work and the welding of light plates and boiler tubes can be handled successfully with an oxygen pressure of 10 pounds, but heavier pieces require a higher gas pressure. Plates of ⅝ inch thickness can be welded satisfactorily with an oxygen pressure of 15 pounds, the acetylene pressure being increased proportionally.

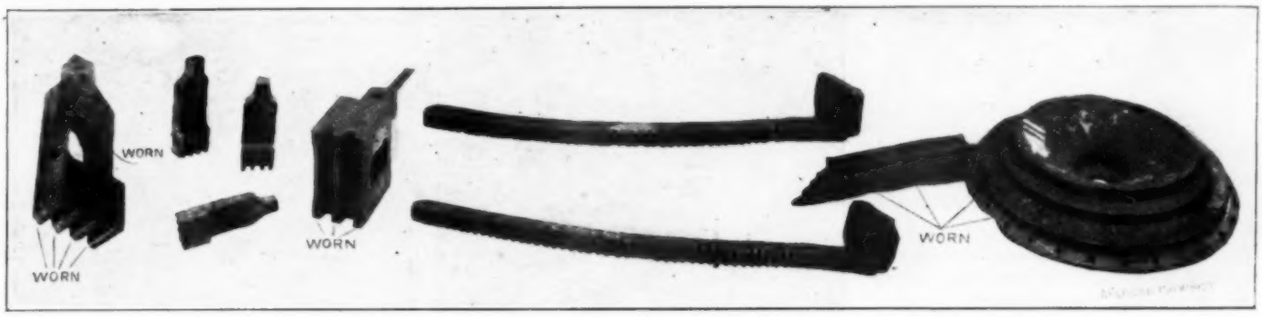


Fig. 7. Reverse-lever Latches

Fig. 8. New Teeth Built Up in a Quadrant

Fig. 9. Steel Cylinder Heads

Applications of Oxyactylene Welding in Locomotive Repairs

Oxyacetylene welding is essentially repair work but the process is well suited to many welding operations on new work, and as it becomes better understood its field of operations will be greatly enlarged. In locomotive repairs its use is being rapidly extended and many iron and steel castings and forgings are repaired in this manner at an expense much less than the cost of renewal. Worn parts, such as links, eccentric blades, crossheads, pistons, valve rods, truck and trailer hangers, and waist sheets, are repaired with a consequent saving of time and money.

Tubes are made by welding in place of the ordinary method of rolling, expanding and beading; thus all liability of delays or excessive maintenance cost, due to leaky tubes in bad-water districts is removed.

Repairs to steel cabs, steel running boards, ashpans, tender cisterns, air and oil reservoirs, and all locomotive sheet-iron work can be expedited and made at reduced cost by the oxyacetylene process. New work of this nature can be made without joints at reduced initial expense and not unlikely reduced maintenance.

With a sufficient supply of gas to permit continuous operation at the necessary pressure, main frames can be welded in position, patches can be applied to broken cylinder castings, cracked bridges in valve chambers can be repaired, and broken spokes welded in driving wheels.

Fig. 10. A Built-up Rod Strap

Fig. 11. A Welded Handle

Also Well Suited to Car-shop Work

Nor is the application of autogenous welding confined to the locomotive shop. The advent of steel construction in passenger coaches and freight cars offers unlimited opportunities in the car shop. The process is especially suited to the welding of the thin sheets of the head lining or siding and the application of bracing at the window framing in the all-steel coach when built new; this is also true of patch work when these parts are in need of repairs.

The liability of leaks would be eliminated on oil-tank cars if the sheets were welded together in place of riveted, which should be an important item in the transportation of the lighter oils. Welded tanks would tend toward a reduction of maintenance costs and permit the cars to remain in service for longer periods.

Repairs to the body of steel freight cars can be handled in many instances to better advantage by the oxyacetylene blowpipe than by the air hammer. This is also true of many repairs to steel underframes.

In working over wrecked equipment of steel construction, many parts are now consigned to the scrap pile due to a high stripping cost. These parts can be saved through the employment of the cutting-off burner.

In the machine shop the oxyacetylene flame is extremely valuable. Repairs to machines are handled economically and with despatch; imperfect castings due to blow or sand holes are reclaimed; broken dies for either machine or steam hammer are built up where worn and redressed;

teeth are renewed on gear wheels, and a variety of work of similar nature is handled with consequent saving in time and labor.

The introduction of this method of autogenous welding into railroad repair shops has proved so satisfactorily in the repair of broken parts, the adding of metal to parts worn by friction, and the reclaiming of defective castings as to warrant its continuance; and as investigation develops new uses, its field of service will be constantly enlarged.

Illustrations of Typical Jobs Done

The accompanying photographs illustrate a part of the work now handled in Topeka and show the class of work to which this is readily adapted.

When piston rods become loose at the crosshead fit renewal is necessary under the old method. By building up the fit autogenously, Fig. 3, and re-turning at an expense of $3 the old rod is made serviceable. As a new piston rod would cost from $12.50 to $18, there is a net saving of from $9.50 to $15 for each rod repaired in this manner.

In building up the crosshead fit on a piston rod, the rod is heated in the forge previous to the use of the blowpipe, Fig. 4. The work can thus be handled in shorter time and at considerably less expense.

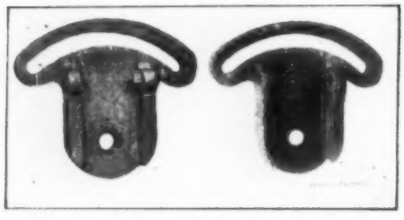


Fig. 12. A Shaper Head Repaired

Links become worn either by the eccentric blades or blocks, Fig. 5, making renewal necessary under the old method. By building up the worn places with the autogenous welding at a cost of $4.02 the necessity of supplying a new link at a cost of $43.40 is removed. The net saving due to the new process is $39.38.

Fig. 6 shows a part of a reverse lever badly worn (on the right) from contact with a single-bar quadrant and the lever after having been built up by the autogenous process (on the left). The necessary blacksmith machine and bench work to renew this part of the lever would have cost $7.90, while the autogenous welding and refitting cost but $2.25; a net saving of $5.65.

When the teeth on a reverse lever latch, Fig. 7, become worn it is necessary to replace the latch with a new one costing $1.52, while the use of the autogenous process permits the building up of new teeth at an expense of $0.71 including dressing ready for service. This effects a net saving of 82 cents on each latch repaired in this manner.

Other Economies Effected

The teeth in quadrants become worn and broken, Fig. 8, making it necessary by the old method to insert new teeth by dovetailing at an expense of $1.38 for an insertion of two teeth. With the autogenous process two new teeth can be built up and dressed at a cost of $0.71 or a saving of 59 cents. The quadrant is considerably stronger when repaired autogenously than by dovetailing insertions.

Two steel cylinder heads, Fig. 9, were badly bent and cracked in a wreck, making it necessary to renew them. By welding them autogenously at a total cost of $5.10 the expenditure of $84.91 for two new heads was avoided, making a net saving of $79.81.

A rod strap, Fig. 10, was so badly worn that it would have been necessary to use a new one at a cost of $18.56. By building up the worn places through the autogenous process the strap can be made entirely serviceable at a total cost of $2.10. In this case the net saving due to the new method was $16.46.

Air-hammer handles become cracked in the arch as shown in Fig. 11. This handle was welded by the autogenous process at a total cost of $0.90 removing the necessity of applying a new handle at a cost of $18, a net saving in this instance of $17.10.

Fig. 12 shows the head for a 24-inch shaper, which was badly cracked at one end and also had a broken lug. This head was welded by the autogenous process, at a total cost of $0.60 as compared with the cost of a new head at $4.10. The net saving in cost was $3.50 and *the machine was out of service less than one hour* as compared with several days' delay by the other method.

The back ends of the frames become badly worn on the top and inside from the working deck casting, Fig. 13, making it necessary to remove the frame and fittings, and to have the frame reinforced at the blacksmith shop, machined, and replaced. With the autogenous process it is not necessary to remove the frame. The repairs in this instance totaled $5.25. If the frame had been removed and the repairs made in the blacksmith shop the total cost of the repairs would have been $41.13.

Fig. 14 shows the welding of the tubes in a Jacobs superheater. The welding of these tubes has prevented leaks and contributed substantially to the low maintenance cost of these superheaters. The same method is employed in welding tubes in a flue sheet of a locomotive, there being no difficulty in welding with the sheet in a vertical position.

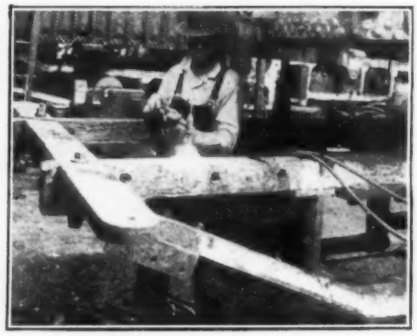


Fig. 13. Repairing A Main Frame

Fig. 14. Welding Tubes

Line Reamer of Machinery Steel

By G. W. Linn

Until recently, the order coming to the tool department to make a small-sized line reamer or broach was one calculated to make me sit up and take notice, for the reason that I never knew whether we would have to make one or four to get one good one. The orders generally called for 5/8 or 3/4 inch in diameter, 18 to 24 inches long and our tempering department tried all kinds of schemes to get those long, slim pieces of tool steel straight enough to grind, but were rarely successful. We tried straightening them between lathe centers using the bunsen-burner scheme, but generally had two pieces when we were through. We also tried leaving an enormous amount to grind, hardening in pipes and between pieces of iron routed out to fit, and careful heating and careful dipping. Finally, as a last resort, we made one out of machinery steel and carbonized it about 1/16 deep, put it between centers, straightened it, ground it to size, backing it off and put it into service. It has been doing severe line reaming for a couple of months and gives evidence that it will last for that many years.

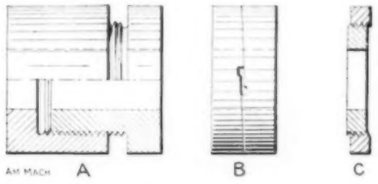
The less jar there is about the running of a wood-turning lathe, the better it will do the work; the machine will last longer and the manager will keep his temper better.

Miller Expansion Collar

By Donald A. Hampson

On duplicate miller work considerable productive time is lost in grinding cutters and resetting. This lost time varies with the material cut, the cutters used, and a few minor details. It increases rapidly as the degree of accuracy of the work becomes closer and the number of cutters in the gang larger. The time spent in sharpening cutters depends on the facilities at hand and the speed of the operator, hence any attempt to place this item on the right side of the ledger must be made by decreasing the time of resetting and maintaining the setting throughout the run. This is the particular function of the expansion collar.

Three designs of expansion collars are shown in the drawing, being sufficient in range to cover all kinds of work. All three should be made of steel, though in special cases other materials might be employed. Collar *A* is adapted to a wide spacing of cutters and may conveniently be made long enough to occupy the full



Miller Expansion Collars

space without the addition of solid collars. Description is unnecessary; reference to the section shows its construction.

Collar *B* should be used in narrow spaces where a safe length of thread (as with design *A*) could not be obtained. It also can, if desired, be made of any length face or to fill entirely between cutters. A notable advantage offered by this collar is that its outside diameter need not be large to insure strength, permitting thereby the use of cutters of smaller diameter. The inner faces of this collar are of a spiral form made by gearing up the lathe (usually 20 or 40 threads) and cross feeding with a side tool, the cut ending each time in the notch shown. When correctly formed this collar offers but one disadvantage for all uses—lack of sufficient adjustment, and lack of stability if opened a half turn or more.

Referring to *C*, the third form of collar is the thinnest. For this reason it cannot be used on arbors unprovided with a keyway and depending on friction to drive the cutters. However, its construction with but one piece in contact with the arbor permits the use of a continuous key as readily as a solid collar (which forms *A* and *B* do not). The threads will be found amply strong for most purposes.

All expansion collars should be drilled and a good spanner wrench made to fit. The time thus saved over the "odd piece of round stock or a nail" method will soon pay for the spanners. Graduations may be provided if desired, and with threads of 20 or 40 to the inch, adjustments to thousandths may be made as readily as with the micrometer.

For the most accurate work it is found necessary to adjust for the slight wear of cutters before they have reached the grinding stage. Expansion collars do this to perfection, as well as when setting up and resetting. Their advantage over taking off a whole string of collars, cutters and nuts to put a paper washer next to the last cutter of the gang does not have to be seen to be appreciated.

Table for Large Drawings

The drawing is made on heavy mounted paper, the length of which is greater than the length of the table but of the same width. The ends of the paper are attached to the drums *A*, one of which is mounted at each end of the table. These drums are carried on a shaft *L*, turning in the brackets *B* screwed to the legs of the table. At each end of the table is a roller *D* made of a cylinder of wood into each end of which is driven a gudgeon. The gudgeons turn in a hole in the brackets *C*. These rollers prevent the paper coming in contact with the edge of the table. They are not absolutely necessary.

The rollers *E* are made of cylinders of wood through a passage through the center of which passes an iron rod *G*, turned at the protruding ends, as shown in the sketch. These ends fit in holes in the plates *F* at the sides, near the ends of the table. The roller *E* turns on the rod *G*, which is so mounted that the roller can be swung above the table as indicated by the dotted lines.

The rollers *E* are not essential; they act as brakes to keep the paper taut as the drawing is shifted by turning the handle *H* of the drums. These rollers should be fairly heavy.

The drums *A A* may be made as follows: A ½- or ¾-inch rod of round iron is threaded for a distance of 4 inches at one end and 6 inches at the other. Two nuts *K K* are then screwed to the end of the thread at each end of the rod. A large washer *J* is then slipped on the rod, next to which are placed the two disks of wood *I I*, about 8 inches diameter. A second washer *J'* is placed against the outside face of each disk, and then the nuts *K' K'* are screwed against the washers; by adjusting nuts *K' K'* and *K K*, the wooden disks can be adjusted to the desired distance apart and firmly held by tightening the nuts. Laths *M* are then tacked to the disks *I*, to make the surface of the drum. The threaded ends of the rod *L* are smoothed with a file to make journals for the ends of the rod turning in the holes in the brackets *B*. A handle *N* is attached to the longer end of the rod *L*. The end of the paper is tacked to one drum and enough rolled on the drum to give the required length for the drawing with a few feet to spare at each end.

To keep the drawing tightly stretched, a number of pins *O* may be driven into the face of one disk on each drum. A cord *P* with weight *Q* can then be hung on a pin of each drum, as shown in the illustration. In order to keep the portion of the drawing rolled on the drums clean, a box may be built around each drum with a slot in the cover for the drawing to pass through. The boxes will, however, interfere with the use of the weights and pins unless the shaft of the drum is extended far enough beyond the ends of the boxes to permit putting in a wooden disk for the pins that will be outside the box.

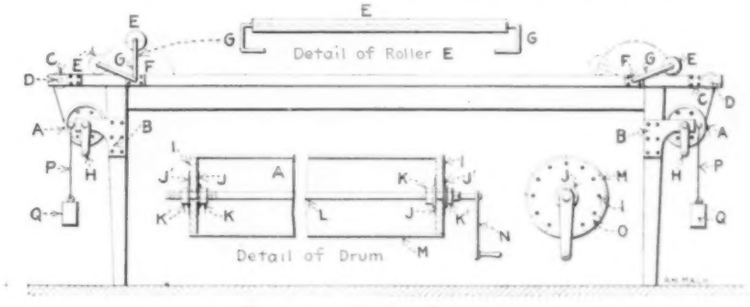


Table for Large Drawings

For light gray iron or malleable work the area of the core room depends entirely upon the character of the product. The fact that in the core storage the cores are kept on shelves one above another and the small ones are dried on cars having several shelves, tends to reduce very greatly the total area required. The cores for a given mold usually take up much less space than the mold itself and they are not accompanied by flasks. For gray-iron work on automobile castings, including cylinders, the core department will have an area varying from 40 to 60 per cent. of that of the foundry.

Boring Holes Accurately on the Miller

By C. L. Goodrich*

A novel method of locating jigs and similar work for the boring of bushing holes to exact center distances.

A bracket with a close-fitting plug is attached to the knee of the universal miller and an adjustable block with a fixed stud is carried at the front of the table. By measuring over the plug and stud with a micrometer any desired setting of the table can be secured to close limits.

A similar arrangement is provided at the side of the knee and column for vertical adjustments.

The accurate boring of bushing holes in large drill jigs is accomplished to a great extent in either the horizontal boring mill or universal miller.

Quite frequently the knee and table-operating screws are used in connection with micrometer dials to position the work correctly with relation to the head spindle for the boring of the various holes, and generally on accurate work, if handled under these conditions, "trial" boring of holes and testing of the center distances becomes necessary together with the inevitable reboring of some holes to correct errors.

To obviate this extra work and to insure that accurate results be obtained from the original boring operations is the purpose of a measuring scheme which is in use at the Pratt & Whitney works at Hartford, Conn., and which is shown in the accompanying illustrations.

How the Attachments are Applied

Referring to Fig. 1, *A* is a stationary bracket which is rigidly secured to the saddle of the miller. *B* is an adjustable block which may be clamped at any point desired, along the slot in the edge of the table. Bracket *A* is provided with a fixed bushing which should be carefully made. The bushing is hardened, ground and lapped and is adapted to receive a plug *C* as shown in Fig. 2. This plug should be hardened, ground and lapped to a close fit in the bushing.

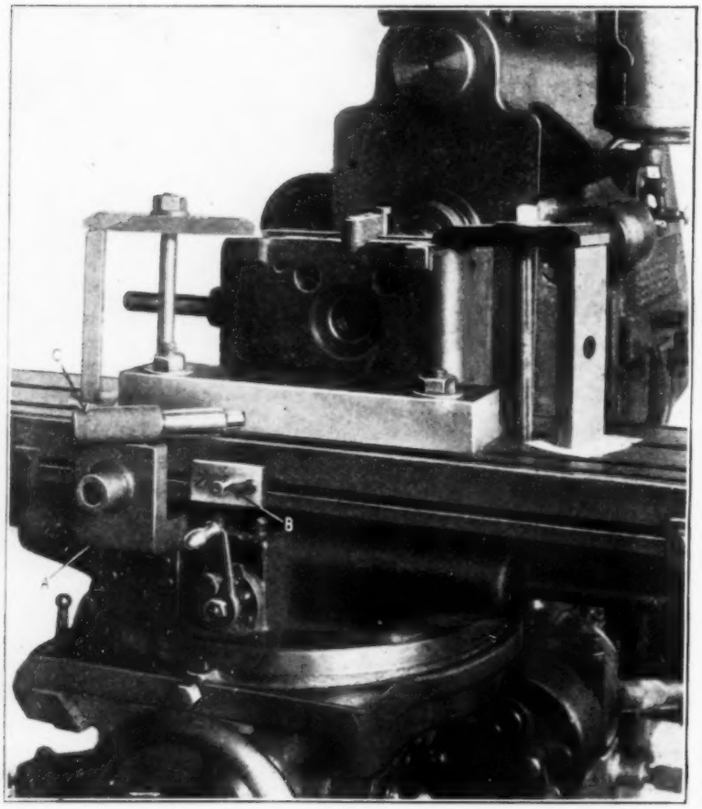
The adjustable block *B* has a hardened, ground and lapped stud permanently secured in such manner as to permit the use of a micrometer for measuring distances in connection with the plug *C* as shown in Fig. 3. Any longitudinal adjustment of the table may be checked by using a micrometer over the stationary plug *C* and the stud in block *B* as indicated. Any vertical adjustment of the knee may likewise be accurately checked by use of a micrometer over a plug and stud located on the column and knee as shown in Fig. 4.

The Scheme in Use

In use, the method is to adjust the block *B* quite closely to bracket *A*, when boring the first hole in a jig, and before moving the table for boring a second hole in the jig, to insert the plug in the hole in bracket *A* and with a micrometer ascertain the exact distance over the plug in *A* and the stud on *B*. Having noted the distance, the table may be moved to the correct location for boring other holes and its location checked before boring is attempted.

It has been found convenient to have

*Department foreman, Pratt & Whitney Company.



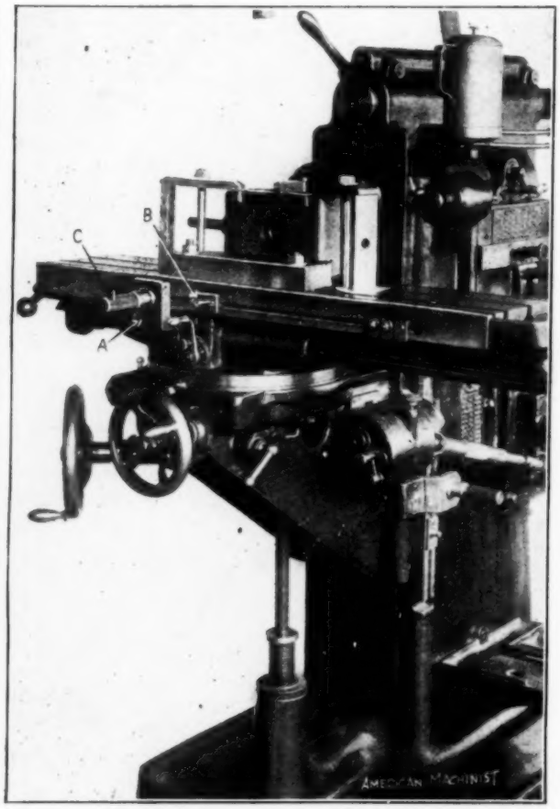


Fig. 1. Attachments for Locating Holes Accurately on the Universal Miller Fig. 2.

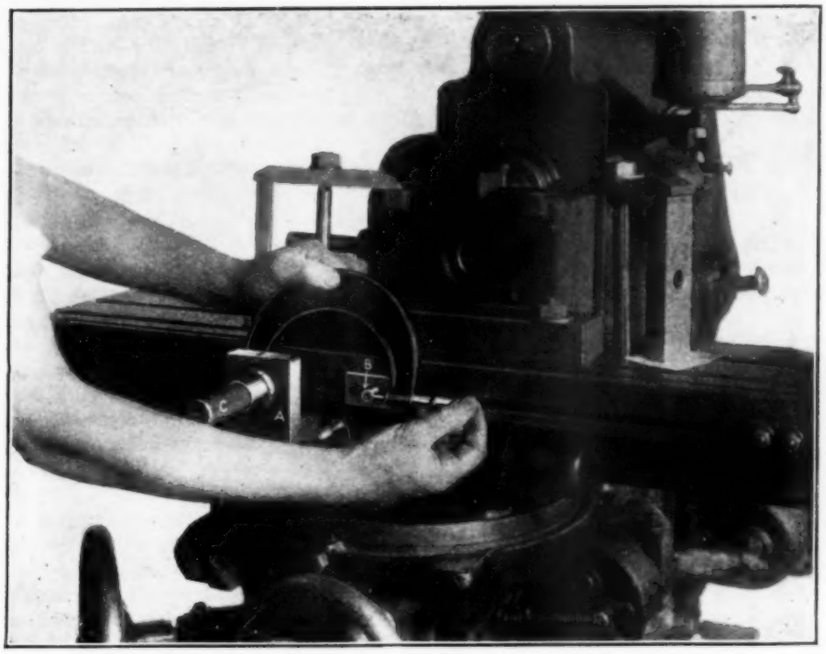


FIG. 3. MEASURING OVER THE PLUGS WITH A MICROMETER IN ORDER TO CHECK LONGITUDINAL ADJUSTMENT OF TABLE

two of the blocks *B* for the horizontal movements, two for the vertical adjustments and to space them a known distance apart, and, thus, with the aid of a given size micrometer making possible the measuring of distances double the micrometer capacity.

By withdrawing the plug *C*, Figs. 1 and 2, the table may be operated to the right or left without disturbing the adjustment of block *B*: hence a still greater range with a given size micrometer is possible, as measurements may obviously be taken in both directions.

In many cases the use of end measuring micrometers has been found convenient.

In boring jigs with the equipment it has been found possible to produce results within 0.0005 inch with no unusual effort. The use of vernier scales, with which it is presumed most readers are familiar, does not, in practice, seem to prove as accurate a method.

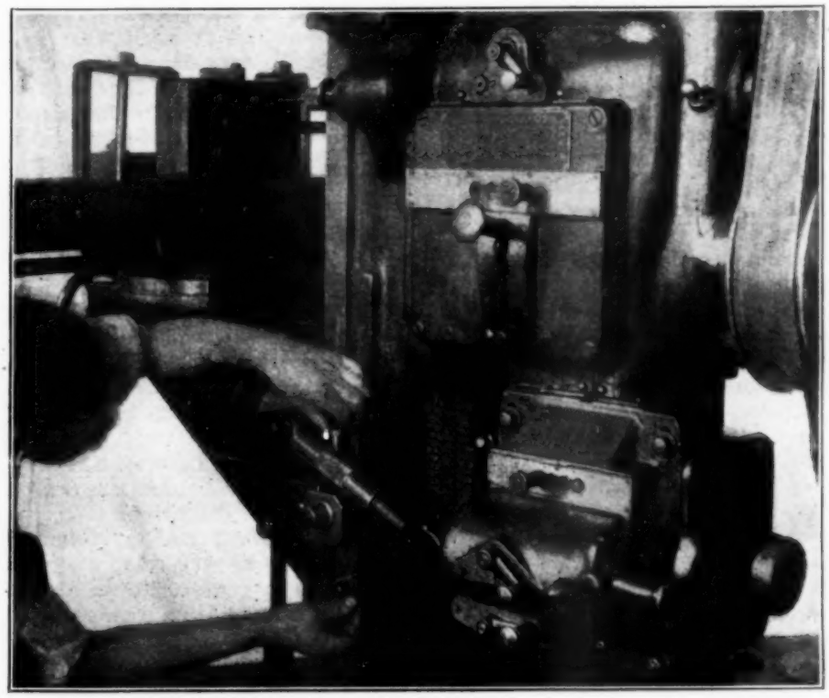


FIG. 4. USE OF MICROMETER IN CHECKING VERTICAL ADJUSTMENT OF THE KNEE

A Filing Cabinet System

BY H. C. WRIGHT

Filing cabinets may be exceedingly valuable or they may be worthless. The idea of the cabinet, naturally, is to preserve the papers for future reference. The value of the cabinet, then, depends on its simplicity and accuracy.

For some time past we had considerable trouble with our correspondence. When papers were wanted they could not be found, and it usually meant more than one man's time, too, as the papers were usually wanted to settle some point of discussion. The filing cabinet I used had 75 drawers, and at first I planned to put the name on each drawer, but this method had two bad drawbacks: First, some papers naturally came under general headings, and unless they were put away personally, I was never sure of their location, and, second, anyone could come into the office, glance over the file, see just where certain papers were located and take them away without my knowledge.

Such conditions made a change necessary, and the result is a system which is adapted to any individual file, such as that kept in a superintendent's or purchasing agent's office. Drawers are set aside for certain papers that have been or are liable to be received. Each drawer has a number, which is the only information given on the outside. A small chart shows all of the names of various drawers and their respective numbers, and this chart is kept where it can be used for reference only.

When a paper is received that will require filing, the number of the drawer in which it is to be filed is marked on the sheet, and the office boy does the rest. In case any paper is wanted, I merely refer to the chart and ask for file 26, or whatever the number may be; the boy brings it and I select the papers.

This system is working and will work wherever installed, and the filing time is lessened, as no thought is required and the work can be done by any boy. It is private, as you alone have the key. Its accuracy is assured, as you designate where you want the paper put, and the result is a clean-cut cabinet with your correspondence where you can get it when it is wanted.

The plant of the United Shoe Machinery Company at Beverly, Mass., for the manufacture of boot and shoe machinery is the first factory constructed entirely of reinforced concrete, and stands today as the most extensive example of the use of this form of construction for machine-shop purposes in the country. The present floor area aggregates 600,000 square feet and when the addition now being erected is completed, the total floor space will be 744,000 square feet, or more than 17 acres.

The Task and Bonus System*

By H. L. Gantt†

The necessary appliances and instruction for doing the work are furnished the workman, and he is allowed a bonus if his work is done satisfactorily in the time set. This is really a system of education with prizes for those who learn.

*Abstract of an address given at the convention of the National Association of Machine Tool Builders.

†Consulting engineer.

The system may be described in a general way as follows: A card is made out showing in detail the best method we can devise of performing each of the elementary operations on any piece of work, specifying the tools to be used, and setting the time needed for each of these operations, as determined by experiments. The sum of these times is the total time needed to complete the piece of work. If a man follows his instructions, and accomplishes all the work laid out for him as constituting his proper task for the day, he is paid a bonus *in addition to his day rate which he always gets.* If, however, at the end of the day he has failed to accomplish all the work laid out he does not get his bonus, but simply his day rate. As the time for each detail operation is stated on the instruction card, the workman can continually see whether he is earning his bonus or not. If he finds any operation which he cannot do in the time set, he must at once report to his foreman, who must show him how to do it, or report to the man who made out the instruction card. If the latter has made an error he must make out a new instruction card, explaining the proper method of working and allowing the proper time. If, however, the instructor contends that the work can be done in the time set, he must show the workmen how to do it.

It is of the greatest possible importance that errors in making out instruction cards should be as few as possible. A man must be allowed time only for what is stated on his card. As a reasonable time is allowed for each operation he should fail to receive his bonus if he does not perform his task in the time set. (The foremen also receive, in addition to their day wages, compensation proportional to the number of their men who earn a bonus and an extra compensation if *all* earn bonuses.)

As these cards are made out by a skilful man, with records of investigations at hand, they invariably prescribe a better method for doing the work than the ordinary workman, or foreman, could devise on the spur of the moment. As all the appliances and instructions necessary for doing the work are furnished, and a bonus is allowed the workman in addition to his regular rate if the work is done satisfactorily in the time set, it will be seen at once that this method is really *a system of education with prizes for those who learn.* The results obtained bear out this idea of education most fully, for under this plan men have learned more in a few months than the same men ever did before in years.

The Scientific Method

In order to get the information needed to make good instruction cards, a very large amount of detail work is necessary. When we realize, however, that any operation, no matter how complicated, can be resolved into a series of simple operations we have grasped the key to the solution of many problems. Further study leads us to the conclusion that many different complicated operations are composed of a number of the same simple operations performed in different orders, and that the number of elementary operations is frequently smaller than the number of complicated operations of which they form the parts. Just as the number of letters in the alphabet is smaller than the number of words in the language. The logical method, therefore, of studying a complicated operation is undoubtedly to study the simple operations of which it is composed. A thorough knowledge of these will always throw a great deal of light on the complex operation. In other words, the time needed for performing any complex operation must necessarily depend upon the time and method of performing the simple operations of which it is composed. The natural method of informing ourselves about a complex operation is to study its component elementary operations. Such study divides itself into three parts, as follows:

An analysis of the operation into its elements.

A study of these elements separately.

A synthesis, or putting together the results of our study.

This is recognized at once as simply the ordinary scientific method of procedure followed whenever it is desired to make any kind of investigation. It is well known that until this method was adopted, science made practically no progress. If it is desired to obtain the correct solution of any problem, we must follow the well beaten paths of scientific investigation, which alone have led to reliable results. The ordinary man, whether mechanic or laborer, if not instructed but left to himself, seldom performs any operation in the manner most economical either of time or labor. It has been conclusively proved that even on ordinary day work, a very decided advantage can be gained by instructing the men how best to perform the work they are set to do. When these instructions are the result of scientific investigation the gain in efficiency is usually beyond our highest expectations.

It is perfectly well known that nearly every operation can be, and in actual work is, performed in a number of different ways. But it is self-evident that these ways are not all equally efficient. As a rule, some of the methods employed are so obviously inefficient that they may be discarded at once, but it is often a problem of considerable difficulty to find out the very best method. It is only by scientific investigation of all the elements that we can hope to arrive at even an approximate solution.

Instruction Cards

When a task is set for any kind of work with which the men are not thoroughly familiar, it is obviously only simple justice to them that they should have detailed instructions how to accomplish each of the elements of the work in the time needed to earn the bonus. Permanent piece rates can be set only when the instructions are such as will insure accomplishment of the work in the minimum time. To get sufficient information to make out instruction cards suitable for permanent piece rates is often a long and tedious operation. On the other hand, instruction cards may be made out to show the best method of doing work which we can devise with our present knowledge and appliances. Such cards may not represent the very best method of performing the work, but will usually represent a method far superior to that which the ordinary workman would employ. If we can get the men to do the work as directed on these cards, we can very largely increase the efficiency of their work.

This is a most obvious way of increasing output. But to base a piece rate on such an instruction card would be simply inviting trouble, for but few men could see that it was just to change a piece rate when we changed the method of doing the work. If, on the other hand, we allow the men their day rate and offer them a bonus for doing the work in accordance with our instruction cards, they see at once that they have nothing to

lose by conforming to our wishes and all to gain, with the result that in a short time they will make an effort to do the work in the manner and time set. As stated in advance, these instruction cards do not necessarily represent the best possible method of doing the work, but the best method which we could devise at the time. We have found that there is practically no objection on the part of the men to a change of time on these cards, *so long as the new time corresponds to a new set of instructions which will enable them, without additional hardship, to perform the work in the time set. This difference between ordinary piece work and our bonus system is fundamental.*

It is hard to overestimate the value of a complete set of instructions showing the best method we can devise of performing a piece of work; when we come to consider the question of piece work, the payment of a bonus, or any method of compensation, proper instructions embodying our best knowledge on the subject are indispensable to good results.

Gang Bosses, Investigators and Instructors

In a shop operated on this system, where each workman has his task, one man whom we term a *gang boss* usually attends a group of workmen, supplying them with work and appliances and removing the work when finished. Such a man is paid a bonus for each workman who earns a bonus, and an extra bonus if all of his group earn bonuses. The result is that so long as the workmen perform their tasks, though nominally their boss he is really their servant, and becomes the boss only when a workman fails to perform his task. The loss of money to the gang boss in case a workman fails to earn his bonus is such that he constantly has his eye on the poor workman and helps him all he can. If, however, he finds that the workman is incapable of being taught he uses his influence to have a better man put in his place.

In starting a shop on task work, an instructor who is capable of teaching each workman how to perform his task must be constantly on hand, and must as a rule teach one workman at a time. This instructor may be the man who has investigated the work and set the task, or he may simply be an instructor capable of following out the work of such an investigator. But he must be readily available as long as any of the workmen need his services, for we make it a rule not to ask a man to do anything in a certain manner and time unless we are prepared to show him how to do it as we specify.

If after having performed his task a workman wishes to suggest a quicker or better method for doing the same work, he is given an opportunity if possible to demonstrate his method. If the suggested method really proves to be quicker or better, it is adopted as the standard, and the workman is given a suitable reward. *No workman, however, is allowed to make suggestions until he has first done the work in the manner and time specified.*

It is the duty of the investigator to develop methods and set tasks. Unless the methods developed by him are generally a great deal better than those suggested by the workman he is not retained for the position. Working at tasks is good training for task setting. I have gotten more than one task setter from the ranks of the task doers.

Inasmuch as a large proportion of the work of the task setter is the study of the time in which the operations can be performed, he is popularly known as the "time study man." This term has led to a misconception of his duties and has caused many honest people to claim that they were putting in our methods when they have put a stop watch in the hands of a bright clerk and told him to find out how quickly the best man was doing certain work.

Development of Standards

The time-study man must be of a far higher grade than this. To make real and permanent progress, he must be able to standardize appliances and methods and write such instructions as will enable an intelligent workman to follow them. Such standards become permanent. If the workman is paid a proper bonus for doing the work in the manner and time set, he not only helps maintain the standards, but soon begins to exert his influence to help the progress of standardization.

The fact that the task and the bonus enable us to utilize our knowledge and maintain our standards, and that the setting of tasks after a scientific investigation must necessarily not only increase our knowledge but standardize it, brings to our assistance the clearest thinkers and the hardest workers in any organization. Our greatest help, however, comes from the workmen themselves. The most intelligent soon realize that we really mean to help them advance themselves; the ambitious ones welcome the aid of our instructor to remove obstacles that have been in their way perhaps for years. As soon as one such man has earned his bonus for several days, there is usually another man ready to try the task, and unless there is a great lack of confidence on the part of the men in the management the sentiment rapidly grows in favor of task work.

Training Workmen

When 25 per cent. of the workers in a plant are bonus workers, they, with those who are striving to get into their class, control the sentiment and a strong spirit of coöperation develops.

The development of skilled workmen by this method is sure and rapid; wherever the method has been properly established *the problem of securing satisfactory help has been solved.* During the past few years while there has been so much talk about the "growing inefficiency of labor," I have repeatedly proved the value of this method in increasing its efficiency. The fact that the system works automatically, when once thoroughly established, puts the *possibility of training their own workmen within the reach of all manufacturers.*

Any system of management that did not make provision for obtaining proper materials to work with would be thought very lax. The day is not far distant when any management that does not make provision for training the workmen it needs will not be regarded as much better, for it is by this means only that a system of management can be made permanent.

An investigation of every case of lost bonus keeps the management closely in touch with the progress of the work, and as the workmen are ever ready to disclose and help remove the obstacles that prevent their earning their bonus, the managing problem is greatly simplified. As one of my co-workers has very aptly put it, *"the frictional lag due to the inertia of the workman is changed by the bonus into an acceleration.*

The location of a core room should be such as to minimize the handling of the cores, being nearer the molders in the case of very heavy work handled by the main cranes, or in cases where delicate cores are used, as in aluminum or light crucible steel work, and being centralized when they are strong enough to stand transportation. The area will depend upon the product, and a fair estimate may be obtained by taking the number of cores required per man per day, and estimating the number of cores the coremaker will make per day, thus arriving at the number of benches required. The space occupied by coremakers' benches is as a rule about 35 to 40 per cent. of the total core-room space, the balance being taken up with ovens and storage racks for green and dry cores.

The first successful solutions of the problem of using liquid fuels in internal-combustion engines were naturally attained with gasolene. This fuel, the lightest of the hydrocarbons obtained by fractional distillation of crude oil, vaporizes at comparatively low temperatures and readily forms an explosive mixture under ordinary atmospheric conditions. Only some form of carbureter was therefore required, aside from the usual constructive elements of the gas engine.

Making Rolls for Sugar Mill Work

By Fred H. Colvin

The squeezing of the juices from the sugar cane requires more machinery and more power than might be imagined. For, strange though it may seem, it approaches rolling-mill work very closely in many respects.

Rolls weighing from 5 to 8 tons without their shafts, are bored on a lathe and driven by the friction of the shaft forced in at 600 tons pressure.

The best equipped shop in New Orleans is conceded by everyone to be that of Bancroft, Ross & Sinclair, makers of sugar-mill machinery. They have a large shop, well filled with modern machines, many of them being electrically driven, They also have a large iron foundry and a steel-casting plant, using the Tropenas process, said to be the only one in this section of the South. At the time of my visit they had just shipped a complete, nine-roll mill to Porto Rico and two others to plantations in the southern States.

Sugar mills are very closely related to rolling mills when it comes to the character and severity of the service, for, although squeezing the juice from the cane may seem easy as compared to rolling steel shapes, there is not the difference one might expect. It takes a lot of pressure and power to roll cane dry enough to burn in the boiler furnace, as broken shafts of 16 or more inches in diameter will testify.

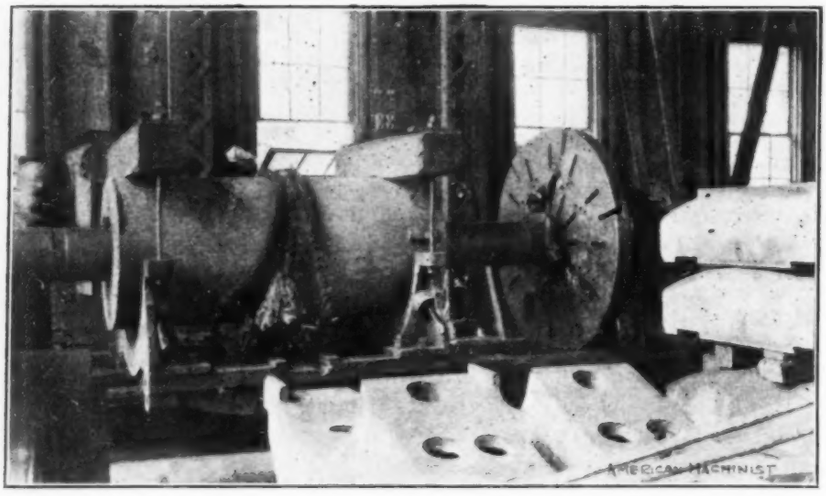


FIG. 1. BORING SHAFT HOLE IN 5-TON SUGAR-MILL ROLL

The rolls vary in size, of course, but an average roll is shown in Figs. 1 and 2, being bored for a steel shaft 16 3/16 inches in diameter. The finished diameter of the roll is to be 32 inches, its length is a trifle over 6 feet, about 6 inches being turned off to insure soundness, and they are handled by an overhead crane, using the rope sling shown.

The rolls are cast of a special iron which must be hard and tough, and must have the further quality of not glazing from the cane, as this would slip on the cane and not feed it through, choking up the whole line of work in the rolls.

These rolls are generally grooved to shred the cane and extract all the juice, leaving it merely fit for fuel.

The roll shown weighs about five tons, and is supported on the lathe carriage by the cradles and blocking shown, being fed along over the boring bar in the usual way. The cutting tool can be seen at *A*, near the tail end of the roll, having just been set out for a new cut. One of the first or breaking rolls is also shown near the lathe.

These rolls are then pressed on a steel shaft, no keys being used. An allowance that will require about 600 tons pressure is used and drives the rolls without slipping. The shafts are driven by couplings or muffs, as they are called in some sections, the shaft ends being either squared or having teeth or a deep keyway cut in them for this purpose.

A repair job of this kind is shown in Fig. 3, where the shaft *A* is being held vertically in a concrete pit under the big radial driller. This just takes the full capacity of the radial, even with the arm at its full hight, and gives some idea of the kind of work which comes to a shop of this kind.

These rolls are driven by heavy cast-steel gearing, some of the large gears running up to 16 or more feet in diameter and of 12- to 18-inch face. The large gears are in two parts, the outer or toothed portion being of steel and having pads on the inside, to which the spokes, usually six, are fastened. These gears have the pads bored on the inside for the spoke ends, and the faces or ends of the teeth turned, as they must run fairly true, so as not to consume too much power.

At the time of my visit, the toothed rim of a large wheel had contracted in cooling, so as to be out of round more than the limit allowed. To get it back into shape, so that it could be bored for the spoke spider, all sorts of devices were tried. Peening did not seem to give the desired effect and, screw jacks, working

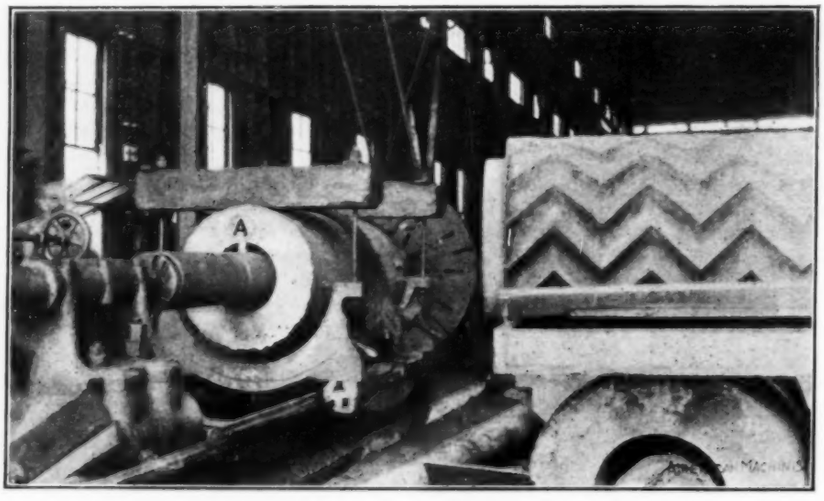


FIG. 2. CANDLE FOR HOLDING ROLL AND FIRST CANE-BREAKING ROLL

against the desired spots inside the rim, were being used to force it into shape. The plan was to fasten it in place by solid clamps on the inside, bore the pads for the spider, and drop it into place before releasing the clamps, which were holding the rim in the correct position.

The bearings for these rolls are provided with the best anti-friction metal obtainable, in order to counteract the heating and cutting, due to the cane juices

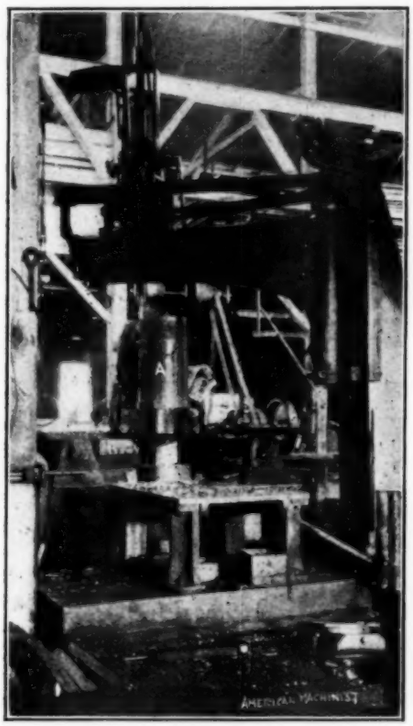


FIG. 3. DRILLING DRIVING END OF SHAFT STANDING IN CONCRETE PIT

getting into the bearings. The pressure on these roll bearings is probably as heavy as those used in steel mills, hydraulic devices being used in some cases to force the rolls together.

There is such a lot of different kinds of machinery used in a sugar-mill outfit, that it affords an interesting variety of work. And those who feel that their field of activity is limited in the large manufacturing plant where a man runs the same kind of a machine from one year's end to the other, will be interested in the opportunities this work presents to the all-around man.

Every courtesy was extended by the proprietors for securing illustrations and data.

An Experience in Rejuvenation

BY B. E. ROSS

It is a surprising fact that in many modern shops, especially those that have developed through a number of years, there are certain departments which are antique in methods and equipment, and entirely out of keeping with their surroundings.

It was my fortune to be employed by a large lathe shop for the express purpose of cleaning out some of the before-mentioned rubbish heaps. The first assignment was the drilling department, for in the words of the chief, they would have "to shut it down or it would shut itself down unless something was done."

The arrangement was two rows of machines with an open (?) space between. There had been a number of nice benches made in the shop, and rather than let them go to waste one was put in the middle of this space. This served as a nucleus. Around it and on it was gathered every conceivable part of the lathes, current and discarded alike, so that to get in and out it was necessary to climb over heaps of partly finished work.

The machine equipment was much in the condition you would expect. Some of the drillers looking as though they might have been used to put treenail holes in the ark. Their only recommendation was, there was so much freedom of the mating parts that they could be run almost indefinitely without sticking. The more modern machines were in a general state of despair.

The drill grinder, being located near the aisle, had been used by men from other departments for grinding castings and the like, and in consequence was broken and out of commission for its original purpose.

The jigs and tools were kept in the department and added their share to the general confusion.

WHERE THE REJUVENATION COMMENCED

Never having seen anything quite so far gone, it was a question where to administer the first dose of restorative. Just as rescuers would open a filled-up mine, it was necessary to work in from the main aisle. With the bench removed and work sorted and neatly stacked, jigs and tools gathered and placed in properly labeled shelves, a permanent open aisle left midway between the machines, and the grinder repaired, there was a breathing space and chance to begin on the machines. Dark nights and cold holidays were spent rebabbitting, repairing and re-alining for it was a maxim of the shop that every machine must be kept running during working hours.

The question of speed came next. Although high-speed drills were furnished they could not be run at the proper speed. A new all-geared driller in another part of the shop was giving splendid satisfaction at about twice the speed of these machines, so the individual lineshaft for the department was run at about double what it had been. It was not as high as used in woodworking shops, but with the poor balance of the pulleys, etc., it seemed a pretty lively pace.

The machines took on a business-like hum and there was a noticeable activity among the men. About that time the superintendent came along. He had never seen anything like such speed before in that shop and it was too much for his nerves. He could see pulleys and countershafts flying through the air and was affected to such an extent that he shut down in short order and reduced the speed to nearer what it was before.

However, in spite of drawbacks the seed was sown and with a new foreman the work began to flow swiftly and smoothly through the department. Instead of everybody having his work tied up there, the department was soon looking for work.

Is Oil Tempering Reliable?

BY HERBERT S. DAVIS

In the shop where I work we do considerable tempering by the above method in a small furnace which takes pieces up to seven inches diameter and about two inches thick. Most of the work is much smaller and of intricate shapes, by far the greater majority being woodworking tools which must be of a temper that can be just nicely filed and which corresponds to the old blue temper.

Now to the point: We have been using this method about three years and this is the second lot of oil we are now using; we have noted that when the oil is new (this with both lots) the right temperature by our thermometer is 560 degrees for what would be the blue temper by the old methods and files perfectly, but as we keep using the oil we have to allow the temperature to gradually rise higher until it now takes 600 degrees to secure the proper temper. This has been the same experience with both lots of oil.

When we noted this with the first lot of oil we tested the thermometer for accuracy and found it to be correct. We then bought the second lot of oil and had the above results.

Of course by our method of sharpening and having our tools ready for immediate use before shiping, we have been able to keep track of the temper and keep it correct and have been caused no trouble in the matter except the care of observation.

It might be interesting to know whether any more of the readers of the AMERICAN MACHINIST have noted anything similar to this. I might say the flash test of this oil is 650 degrees and would add that outside of the above troubles the temper is absolutely uniform; there are no hard and soft spots.

The Boston Anti-Smoke Law, which was enacted last year, has not only eliminated to a large extent the smoke nuisance. but also has aroused among engineers a keen interest in the problem of combustion.

Core Room Location and System*

By H. M. Lane

The location and area are more important than most foundrymen realize, since the modern tendency is to throw an increasing responsibility upon it.

The factors that decide the location. Estimating the area.

*Extract from a paper presented before the American Society of Mechanical Engineers.

The location and area of the core room are of more importance in the production of castings than most foundrymen realize, since the modern tendency in certain classes of work is to throw an ever-increasing responsibility on it, and some complicated castings, such as air-cooled automobile cylinders, are made in molds that are composed entirely of cores. The definition of a core, as already given, was carefully chosen with this phase of the subject in mind. The location depends upon several factors: The size of the individual cores, the number of pounds of cores used per molder per day, the strength of the individual cores and the method of handling the cores from the core room to the molders.

Core-room Area

A series of observations of the proper area of the core room, extending over about 15 years, has shown that the core room varies in area from 10 to over 50 per cent. of the molding floor. This includes the space occupied by the ovens and core storage, but not the core-sand storage. In very heavy gray-iron work, such as large Corliss engine cylinders, heavy machine-tool castings, large forging machines, etc., the space devoted to core making may be equal to at least 60 per cent. of the active molding-floor space, but in this kind of heavy work about half is usually inactive, because heavy castings must be left in the sand several days to cool, hence the area as compared with the molding floor is about 30 per cent. of the total.

The core-room proportion in the case of side floor work in a gray-iron foundry is generally much less, because many of the molds require no cores, and as a rule the floors are cleaned each day, so that the entire molding area is continually active and varies from 10 to 15 per cent. of the area of the side floor.

In the case of loam work, frequently only a very small number of cores are used, which are not made on the loam floors, but, of course, when loam work is being carried on, drying ovens are necessary, and the entire proposition partakes of the nature of a core problem.

For light gray-iron or malleable work the area of the core room depends entirely upon the character of the product. The fact that in the core storage the cores are kept on shelves one above another, and the small ones are dried on cars having several shelves, tends to reduce very greatly the total area required. The cores for a given mold usually take up much less space than the mold itself, and they are not accompanied by flasks. For gray-iron work on automobile castings, including cylinders, the core department will have an area varying from 40 to 60 per cent. of that of the foundry. In aluminum work for automobiles it is about 40 per cent., in brass jobbing shops 10 to 15 per cent., for brass fittings 20 to 25 per cent., while for iron castings it takes from 20 to 45 per cent.

The core-storage space to be provided is also important. In the case of jobbing work comparatively little room is necessary, since the cores when completed are usually sent to the molders' floors. Where a line of standard work is being manufactured, provision should be made for carrying at least one-half of a day's supply of cores, and where night ovens are used for baking, an entire day's supply.

Handling Warm Cores

In order to avoid rehandling whenever possible, cores should be sent from the core-oven trucks to the molders without placing them on storage shelves, as this involves an extra handling. This question, however, brings up the advisability of handling cores hot. With many binders under such conditions more binders will have to be used than if they are allowed to cool.

One large foundry in this country, using a great many oil-sand cores, changes its oil-sand mixtures at about 3 p.m., by decreasing the amount of binder 15 per cent. The reason for this is that the cores made subsequently will be run out of the core oven on to the plates and left to cool over night before they are handled, so that the full strength of the binder will be developed. During the day they are ordinarily taken from the plates hot and carried to the molders. In many cases a saving of 15 per cent. of binder would more than pay for the rehandling of the cores and the placing of a core storage between the core department and the foundry.

Transportation of Cores

Where the number of cores used per molder is so great that the weight of the cores delivered to each approximates the number of pounds of castings turned out by him per day, the problem of transporting the cores becomes serious and must be taken into consideration in locating the core room. In this there must also be considered the element of breakage. Every core that is broken represents not only the loss of the sand and binder but also of the time expended in making it, the fuel for baking, and other labor in the way of transportation. Every possible precaution should, therefore, be taken to reduce this item.

If the cores are large and delciate, such as those required in aluminum or light crucible-steel castings, they must give way readily before the shrinking metal and should be handled as little as possible; hence the core room should be near the molders.

If the cores are standard and sufficiently hard so that they are handled in boxes or in piles on boards as in some fitting shops, they will stand transportation a long way, and here it will pay to centralize the core department, equip it with labor-saving machinery, and reduce the cost to a minimum. The cores can then be distributed to the various departments without fear of serious loss through breakage. In the case of heavy work where they have to be handled with a crane, if there are several separate bays or departments it is frequently more economical to provide each section of the foundry with its own core room and to arrange it so that the main traveling cranes handle them from the core oven trucks to the molds at one operation.

For transporting cores about the foundry we have platforms commonly called boats, which are rectangular in shape, made of plank, with heavy battens on the back, supported at four corners by slings from the crane hook. The cores to be moved are piled on the platform and shifted to the parts of the foundry where they are to be used. For handling and transporting medium or fairly heavy cores a device of this kind saves rehandling and guards against breakage. It also does away with confusion in the gangway due in many plants to carrying of cores to the various floors. In some foundries the cores are carried to molders on a trolley system in boxes or specially prepared cages supported by spiral springs. In other cases spring trucks running on industrial railways are used for the purpose.

In the case of medium heavy work, cores weighing 100 to 200 pounds, the core-oven truck may be arranged so that each shelf can be lifted off by the traveling crane and used as a boat to carry the cores to the floor; in other cases the en-

tire core car may be picked up by the cranes and delivered to the molders floor.

Handling Core Sand

As the core sand is bulky the problem of handling it assumes considerable prominence in most plants, and this necessitates the location of the core room in such a position that the sand can be delivered from the railroad cars into the storage bins with the least amount of handling. For the most effective work the sand should be as dry as possible, hence it should be put into storage at a dry season of the year, and at least a nine-months' supply provided for. Buying the sand at this time of the year also reduces freight costs by eliminating water contained in the sand during rainy periods.

To sum up the matter, the location of the core room should be such as to minimize the handling of the cores, being nearer the molders in the case of very heavy work handled by the main cranes, or in cases where delicate cores are used, as in aluminum or light crucible-steel work, and being centralized when they are strong enough to stand transportation.

The area will depend upon the product, and a fair estimate may be obtained by taking the number of cores required per man per day, and estimating the number of cores the coremaker will make per day, thus arriving at the number of benches required. The space occupied by coremakers' benches is as a rule about 35 to 40 per cent. of the total core-room space, the balance being taken up with ovens and storage racks for green and dry cores.

A Lake Superior Pattern Storage

By F. A. Stanley

A conveniently arranged department in a machine plant for taking care of a large number of patterns of various classes. Storage shelves carried in short lengths between cast brackets which are adjustably mounted upon uprights made of piping.

The Clyde Iron Works, Duluth, Minn., builds steam log loaders, steam skidders, logging tools, hoisting engines, etc., and the production of these lines along with the special work undertaken at the plant involves the construction and storage of a great variety of patterns in numerous sizes, particularly for such castings as spur, bevel and sprocket gears, journal boxes, brackets, pulleys, drums, and the like. The method adopted for storing these patterns is illustrated by the accompanying engravings as reproduced from photographs taken at various points in the building.

Fig. 1. Arrangement of Shelving in Pattern Storage

General Arrangement

Fig. 1 is a typical view taken at some hight above the floor and showing the location of the deck by which access is secured to such shelves as cannot be reached from the floor. This illustration brings out clearly the general method of arranging the shelves in numbered rows, 1, 2, 3, and so on, which in turn are subdivided into sections designated by symbols *A*1, *A*2, *B*1, etc.

The Shelf Brackets

The shelving is carried between grooved brackets adjustably attached to 2-inch piping extending from floor to ceiling. Details of one of the brackets are shown in Fig. 2, and it will be seen that one pattern answers for all brackets, whether they extend to right or left from their uprights, the two brackets when placed together upon the pipe being clamped securely by a pair of bolts and nuts.

Where a single row only of shelves is required, the brackets are clamped by means of a cap like that seen in the detail, Fig. 2.

The channels cast in the sides of the brackets allow the shelving to be slipped readily into place as indicated by Figs. 1 and 3. The brackets are located at short intervals in each row and the shelves are made up of correspondingly short boards which reach from bracket to bracket; a wire which passes under the shelves and connects the two outer brackets preventing the sections in any shelf from spreading apart and dropping.

The single deck at the wall side of the shelves in Fig. 3, is carried by cast brackets of somewhat heavier section than that employed for the shelving supports.

Figs. 4 and 5 represent two other aisles in the pattern storage with a special arrangement of shelving in the latter case, this being in fact a rack made to hold boards upon which molding-machine patterns are gated.

The Pattern Record

A loose-leaf index is used in keeping the pattern record or catalog, and a por-

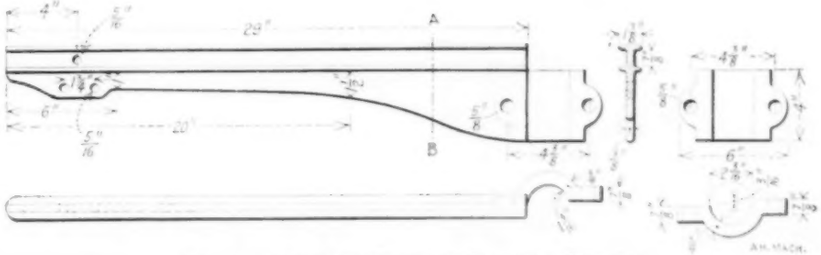


Fig. 2. Shelf Bracket for Pattern Storage

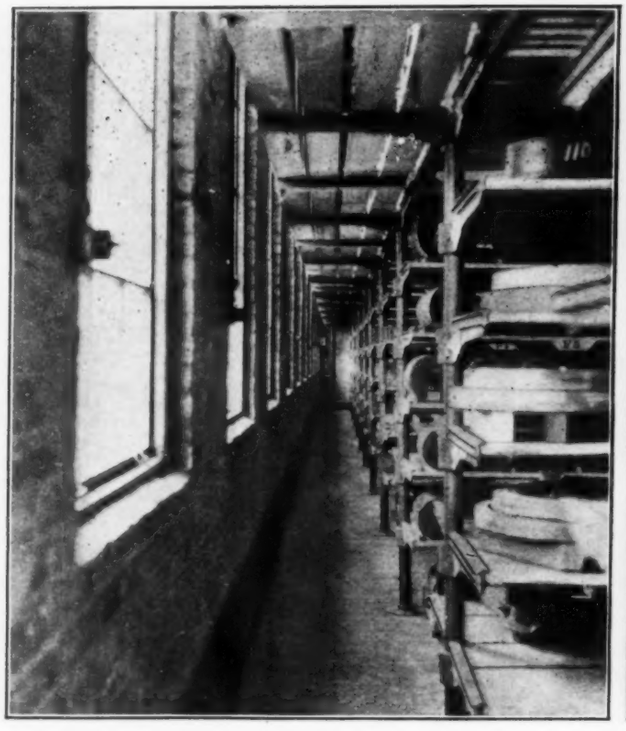


FIG. 3.

FIG. 4.

SHELVING AND DECKS IN PATTERN STORAGE

PAGE 20

| NAME. ANVILS | | |

Is the Right Man in the Right Place?

By Guido Sacerdote

An Italian mechanical engineer who has spent a number of years in this country asks the pertinent question, "Is the right man in the right place in American factories?"

He analyzes the present positions held by engineers and draws the conclusion that the necessities of industries will finally put them into stronger industrial and social positions and that their opinions will receive the respect that they deserve.

Let a European engineer, after many years of experience both in Europe and the United States, be permitted to express his views on this subject, and emphatically to answer NO to the question which forms the title of this article.

I do not pretend to know and criticize all the factories of the United States, nor even a great number of them. But judging from my experiences in several of them, and from the organization chart which is to be found in every standard book on organization, it seems as if the general plan on which the various duties and charges are subdivided is very uniform in American factories. This criticism must necessarily extend to all the factories where this stereotyped plan has been adopted.

The mere plan of organization is, of course, not sufficient in itself to be responsible for the many imperfections that can be found in the management of American factories from the European point of view. But it is one of the determining causes. The others are to be found in local conditions, in the force of habit which persists in maintaining conditions which were probably justified a number of years ago, and—let it be said with no ill feeling—on the unjust and unjustified domination that the bookkeeper and the salesman have over the men concerned with production, the men who are really responsible for successes and achievements in this country.

At least this is the impression, and a strong one, that the foreigner gets when he comes in close contact with the management of American factories. It is a painful impression as of something which is illogical, something that hurts the common sense, besides leaving a feeling of a flagrant injustice done to the engineer and the engineering profession at large.

The Usual Subdivisions of Duties and Prospects

At first, there is the main subdivision into office force and factory force, both depending from the general manager, with a consequent division of duties and prospects. A man who has started in one of these two subdivisions is generally and fatally destined to complete his career in the same one, or, at least, in discharging the same class of duties. There is this difference, however, that the office boy who sweeps the floor and runs errands has a chance to become bookkeeper, assistant superintendent, superintendent, salesman, purchasing agent, head salesman, and general manager if he has intelligence and luck. In other words, he has the chance to fill one of the positions which carry the highest compensation. The factory positions, on the other hand, do not generally open the path to any higher place than chief engineer or superintendent, according to where the career has been started and the technical education of the man. Here again, a striking division of duties can be noticed between the drawing room and the factory; a striking difference betwen the men at the heads of the two departments; a striking difference in the importance accorded to the two positions and their respective salaries.

It seems clear that something must be wrong. Why it is so is hard to say. The question is a most complicated one and must be examined from different sides.

The fact that an office boy has the chance of attaining the highest positions in the industrial world seems to the superficial observer a magnificent example of what democracy can perform. If I am not mistaken, it is, or has been, one of the prides of American democracy. I do not doubt that in many instances men who have risen from the humblest beginnings to a high station in life have been possessed of intellect above the ordinary; but, let us frankly admit that they were fortunate in having a chance to show what they could do.

The Usual Careers

But discarding these examples, which are not the rule, let us consider the everyday career of the man coming from the office force and furnished with just ordinary intelligence and a rather narrow knowledge. This man will often be found filling positions mentioned above, salesman, purchasing agent, and even superintendent. Every one of these positions is better paid than the positions open to the average engineer.

Aside from the fact that I am myself an engineer, I have no admiration whatever for such an order of things. I think that the engineer, as a man, is entitled to be given the same chances as other men. The engineer through long years of study and daily struggles with difficulties, through the broad culture acquired both in and out of college, through alertness of mind from familiarity with difficult and abstruse problems, through ability to attack broad-mindedly both technical and practical questions, is the best fitted to fill the majority of leading positions in any industrial enterprise. I do not mean by engineer the man that has acquired his knowledge and experience entirely in the drawing room, but the man that has actually gone through a complete course of engineering in some college, supplemented by other studies of a varied character belonging more particularly to general culture.

Again, the fact that many a man has risen without having gone through an engineering course does not prove anything. In all probability some of these men have gone through the hardest work to acquire knowledge the lack of which they themselves may have felt more than once; others have had some special opportunity or ability above the ordinary, and others just good fortune.

Training of American and European Engineers

I am not familiar with the engineering education imparted in the colleges of America. It may be that specialization is carried too far. This might to a certain extent narrow the attitude of engineering graduates, and be responsible for the limited fields which they find open in their career. Still, I have known many American engineers personally, and I find them as a rule alert, capable, and quite apt to familiarize themselves with all the varied questions which arise in the management of an industrial enterprise.

I know that in Europe, at least in the Latin countries, the education that an engineer receives is usually very broad and touches many things that do not apparently have much connection with the duties of an engineer, or with the occupations pertaining to the various branches of engineering.

In Italy, a graduate mechanical engineer must go through a complete course in chemistry, electrotechnics, mining and political economy. The civil engineer must also take these same studies, the difference being that the two courses are a little more specialized in those matters which appertain to the particular callings. Both courses have thermo-

dynamics, hydraulics, applied mechanics, etc., but civil engineers have a course in construction (roads, railroads, dams, bridges, structures, etc.,) that the mechanical engineers do not take. But these, on the other hand, have special courses which are not given to the civil engineers.

The mathematical studies are the same in both cases; in fact, the first two years of engineering courses are common for all classes of engineers.

The engineering courses in Italian universities can be followed both by students who come from technical high schools and from classical high schools. The latter are not usually very well grounded in mathematics, drawing and the like, yet it is a recognized fact that in the end they make good engineers; better engineers, as a rule, than those coming from technical schools.

In truth it must be said that the engineers coming out of Italian universities are not familiar with the problems arising in actual practice. But they have a vast amount of information on a variety of subjects, and from a variety of points of view. They are familiar with hard mind work, are good theoretical men, broad minded, adapted to start equally well in any branch of engineering.

They go into factories and other industrial enterprises to start at the bottom in the drawing room. They discharge duties which might well be discharged by younger employees with no theoretical education. But wherever they go, they absorb the practical side of production with wonderful speed, and pass on to important positions. What is more important they are given the chance to do so.

French engineering courses are probably somewhat more specialized, but are supposed to be even more thorough and severe than the Italian. In fact, no one doubts the thoroughness and ability of the French engineers.

In both countries, it is the engineer that has the chance to push his way in the industrial world. There is no such thing as an engineer limited to the pure duties of a chief draftsman, subject to the instructions of a superintendent trained only in work of a practical kind. There is no such thing as an engineer being limited to positions where there is much skill required and little compensation, and an office man advancing in the meantime to the higher grades and salaries.

In Italy, in France, and, I think, also in Germany, in all industrial enterprises the general manager is an engineer. There is usually no division between chief engineer and superintendent, except that the chief engineer, in all probabilities the general manager himself, or his assistant, runs both the factory and the drawing room, the two being parts of the same whole. If there is a superintendent he is subject to the chief engineer. He is very likely a technical graduate of some industrial school. If there be a chief draftsman, he is very likely an engineer, a younger man who has all the chances in the world to see, discuss, learn and may become, some day, chief engineer and general manager.

Such is the case in industries of the most varied character. Not only in the machine-building industry, but also in the textile, woodworking, and even in the oil-making industry. Where also the product is of a technical character, the selling force is composed entirely of engineers; the agents and representatives of such concerns are also engineers.

Fitness of Engineers for Important Positions

It is right that it should be so. The thorough education received by engineers makes them individually, and generally, the best fitted for occupying responsible positions.

The fairness, integrity and straightforwardness of engineers as a class are well known. These qualities are most desirable in men connected with the financial end of any enterprise, and when found together with a thorough technical knowledge, they form an invaluable combination.

It may be objected, that the best proof that the system on which the factories are run here is not bad after all, lies in the evident industrial prosperity of the United States, as compared with France or Italy. This difference is more striking if the comparison is limited to the last mentioned country.

To this I will answer, local conditions and natural resources are largely responsible for the state of affairs. The high cost of labor, importance of the home market, tariff protection, abundance of iron, coal and other natural resources of every kind, these have all been predominant factors in the development of American industries. Of course, the activity and the natural intelligence of the American people have been able to take advantage of this position; the same as French and Italian people would have done under parallel conditions.

Position of the Engineer in American Industries

In what capacity is the engineer employed in America? Aside from those who have means, opportunity and ability to start independently as consulting engineers, those employed in factories and industrial enterprises are really confronted by very poor prospects. Not everyone can be a consulting engineer. The others should not be generally restricted to drawing-room duties. Still, such is the case here.

Why is it that American factories have been so slow in accepting the most modern products of engineering skill, except those appealing to, and perfectly clear and comprehensible to the purely practically trained man? I need only refer to producer-gas apparatus, autogenous welding, water-tube boilers for stationary installations, malleable iron, concrete buildings, flaming arc lamps—all processes and materials used in Europe for years before being introduced here. This proves to me that some quality is lacking in the managers of American factories. This, in my opinion, is a lack of knowledge necessary to weigh the importance of things based on theoretical principles, to value other people's opinions and experiences, and, above all, to form an individual opinion of one's own.

On the other hand, I recall my astonishment a few years ago on reading that some big industrial concerns in the Pittsburg district had freely opened their doors and given financial support to an "inventor," who claimed to have discovered a way to burn ashes. Later, after having been exploited in the daily papers, a few technical journals showed it up for the fake it was.

Things of this kind are absolute impossibilities in any country in Europe. For the engineer passes judgment on things; the engineer holds a position morally very high; his opinion is sought and respected; he occupies the place that he really deserves in the industrial world, as well as in the social world.

American manufacturers cannot fail to realize that competition is becoming more and more keen; that very soon common sense and practical knowledge alone will not suffice. It is to be hoped, if not in homage to justice at least through the necessity of industry, that the American engineering profession will rise to a higher plane. At the same time the engineers must help themselves.

Vicissitudes of the Job Shop—Boring an Engine Pulley

By J. G. Dornbirer

"Engine gone to pieces send expert at once." This was a night message, and the assistant foreman on the erecting floor was sent on his journey of 500 miles.

Here was a high-speed engine, sent out only six weeks before to run an electric-light plant, said to have gone to pieces. When he got there he found that there was no exaggeration about the telegram.

The engine was of the center-crank type, with a pulley on each side about 7 or 8 feet in diameter, 12-inch face. One of these pulleys was lying on the floor, the center crank was broken between the pin and the bearing, the studs for holding the caps on the bearing were pulled out or broken off, one cap was broken, the connecting rod was bent, the eccentric rod was broken, and there were several minor breaks. The engine had a

piston valve, but the engineer saw fit to screw the safety plugs out of the cylinder and substitute gas plugs. The crank shaft was cut from the solid, and you know that 20 years ago material was not as reliable for such purposes as it is now. The break looked as though there had been a blow hole in the ingot from which it was forged.

Water frequently came over from the boiler, knocked out the safety plugs in the cylinder and let out considerable water on the varnished floor of the engine room. So the engineer decided to cut that out by screwing in the gas plugs. The expert from the factory concluded that this hastened the break.

However, he at once looked up the local machine shop and found a 12-inch lathe, a small driller and a machine which looked like a cross between a power hack saw and a bolt cutter. This the proprietor called his shaper. There were also a few small tools. These were the only things in sight to help do the repair job, so the expert telegraphed to the factory for a crank shaft and bearing cap.

The other parts were fixed up in this little machine shop and were ready when the shaft and cap came. When the pulley fell to the floor, the rim struck on the cement foundation of the engine, causing it, as was discovered later when placed on the shaft, to run out sidewise about seven-eighths of an inch.

There was a generator driven from each pulley, and it looked as if the patrons of the company would have to go without electric light for several more nights. The proprietor was using profanity and bad stogies until the atmosphere became opressive. For about the only thing the man from the factory could say was: "I'll telegraph at once." We may have a pulley in stock, and in that case it will be here by express in a few days. If not, it will take about a week."

We have often read discussions regarding the right price to charge for valuable services rendered in a short time; here was one way of doing it. The proprietor of the little machine shop walked up to the man from the factory and asked what he would pay if the pulley was rebored, bushed, put on the shaft and ready to run by that night, with a guarantee that it would be as near true as the other one. The cost of a new one, express charges and telegraph expenses would figure up to about $150. But in a dickering spirit, for the repair man thought that the fellow might have some device for doing it quickly, he offered him $25.

The machine-shop proprietor, notwithstanding the fact that he had invented a clover seeder and grew warts large enough to hang calipers on, was likewise an expert at making a bargain. He said $50 would be cheap for the job in such a way that it bore the ear marks of an ultimatum. This price was agreed upon. Then he stepped over to the owner of the lighting plant and asked what he would give. "I'll give $25 to get this going by tonight at 6 o'clock, and remember this is Saturday morning and 8:30 o'clock."

"What guarantee will you give us that this will be accomplished?" "Telegraph for the pulley if you have any doubt as to the outcome in two hours, which won't delay you much." Then he hustled back to his shop and brought back the device described in the following paragraphs.

The Pulley-boring Rig

He carefully made a gage the size of the bore in the pulleys, then turned two collars to a driving fit in each end of the bore of the true pulley, which was laid on the floor. Then he drove an arbor through the collars. The arbor was about 30 inches long, 2½ inches in diameter, and had 20 threads per inch for about two-thirds of its length.

A sleeve 15 inches long was threaded to screw on the arbor, and had a tool inserted on the bottom edge. Then with a hand hoist the pulley with the bent spokes was laid on top of the true pulley with thick paper between, on the rim, and the two were clamped together. The hub of the pulley to be bored was about 11 inches long and was chambered out for about 4 inches in the center. Next, the above mentioned sleeve was screwed onto the end of the arbor projecting through the upper pulley; this projection was about 3 or 4 inches long. The wall of the sleeve was about ⅝ thick, which permitted fastening a piece of 5/16-inch square stock with a ⅜-inch setscrew in the lower edge.

A 1-inch hole was bored through the upper edge of the sleeve at right angles to its axis, which permitted a bar to go through, serving as a handle to turn the sleeve. A roughing and a finishing cut did the business. This pulley was bored and ready for bushes at noon. The shaft was 4¼ inches in diameter, and the hole in the pulley was bored to 4⅜ inches. A short piece of 4-inch pipe stretched over a mandrel in the blacksmith shop made the bushes, which were carefully turned and slotted for the key in the aforesaid shaper. Luckily the keyseat in the pulley came directly on the side where the tool, when boring the pulley, cut the lightest; consequently it was parallel to the axis of the new bore.

The bushes were tapered a trifle and were drifted in on one side with the cap on the pillow block removed; on the other side it was an easy operation.

The same key, when planed a trifle thinner, was driven in and the engine was started at four o'clock, or eight hours after the job was begun.

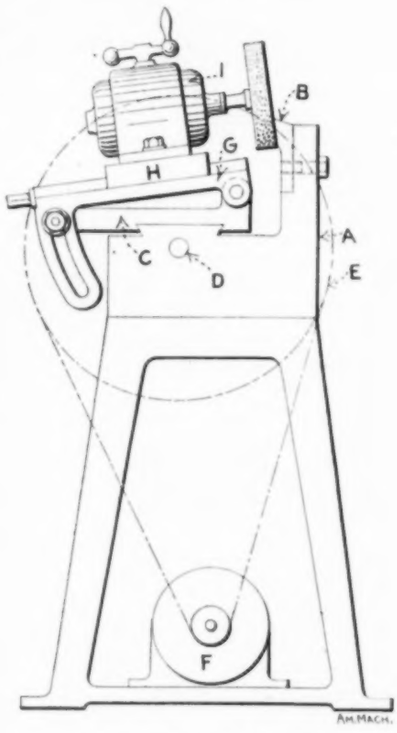
The last pulley which he had bored in this way had a 4½-inch hole, so the bushes only needed turning to fit this job. He said he frequently had pulleys to bore, and instead of the other pulley to support the bar, he had a 48-inch pulley and two large parallel bars for most any job which might come up in that vicinity.

A Shear Blade Grinder

By W. A. Valentine

We had considerable trouble with the blades of our power shears, for if we sent them outside to be ground we had to wait a long time besides having them often come back so crooked as to require packing out at various points to aline them properly, and to overcome these difficulties, we finally made a machine to do the work ourselves.

A is the bed to which the blade *B* to be ground can be bolted in the same way and by the same bolts as when in use on the machine. Slide *C* is fitted to the bed and can be fed in either direc-



A Shear Blade Grinder

tion by screw *D* which is driven by pulley *E* from the motor *F* which has a reversing switch thrown by stops at each end of the slide, to prevent the carriage from traveling too far.

On the slide member *G* is pivoted so as to allow the grinder to be set at any desired angle, and *G* is also provided with a cross slide *H*, carrying the grinding motor *I*, which is a regular center grinder, provided with a vertical adjustment. This machine can be used to grind the face of the blade by using a cup wheel and can also be used to grind the top.

Cam Cutting Machines; Other Tools

Editorial Correspondence

Two special machines for milling face and drum cams, with a provision for holding the work steady and for operating the work and cutter spindles at the desired rate of speed.

A radial driller with a special table for holding large flat frames and similar machine parts that are handled in jigs.

A few tools for machining pulleys and levers.

A number of special machines and fixtures used by the Sigourney Tool Company, Hartford, Conn., are illustrated by the halftone engravings herewith.

The machine in Figs. 1 and 2 is for cutting face cams which are milled right and left hand in opposite sides of the large spur gears shown in the two views. These gears are part of the operating mechanism of a book-trimming machine and the cams in the opposite faces of the gears must be exactly alike to produce the desired smoothness of action upon the part of the members actuated by the cam rolls.

Chief Features of Construction

The main spindle, carrying the faceplates for the work and the master cam, is mounted in bearings at the top of a swinging head *A*, which is pivoted at the bottom about the center of the shaft which drives the head spindle. This horizontal driving shaft *B* actuates vertical shaft *C* by means of worm and worm wheel and the vertical shaft has another worm near its upper end which engages with a worm wheel on the work spindle.

Shaft *B* derives its motion from a gear box which is belted, as shown, from the shaft that drives the cutter spindle. This gear box provides nine rates of speed or rotary feed for the work for each speed of the spindle, the latter having six speeds in all.

The cutter spindle is driven through spur gearing as represented in Fig. 2, and this view shows the weighted chain for drawing the work head forward and holding the master cam or former *D* in contact with the guide roll, which is carried by head *E*.

Control of the Work

The form plate or master cam will be seen to be a simple plate, which is finished to the outline of the inner wall of the cam channel. It is mounted upon an auxiliary plate *F* instead of directly on the faceplate, and this auxiliary plate is really a master plate in that it is provided with dowel holes for correctly locating the different master cams that are used on this machine.

The master cam *D* is used for both right- and left-hand cams and is simply reversed on the master plate *F* when a cam of the opposite hand is to be cut. This secures uniformity in the right and left cam channels in the gears.

In order to avoid all possible vibration in the operation of milling the cam, the swinging head with the work spindle is provided with a pair of rolls which rest at all times upon curved shoes *G*, these being laid out to an arc struck from the center about which the head swings. The free end of the head is thus supported at every point in its travel and chattering is avoided.

Hand Adjustments

The handwheel on the vertical shaft *C* forms a medium for the rotation of the work spindle by hand. The handwheels for setting the cutter and guide heads are located at the ends of the bed. The crank handle *H* operates a worm and a worm wheel on the sprocket shaft and the sprocket may be turned at will by this device to lift the weighted chain and take the load from the head if it is desired to do so in making adjustments, etc.

Ordinarily three cutters are used in cutting the cam, the third cutter finishing both sides of the cam slot and bringing the cut to the required width.

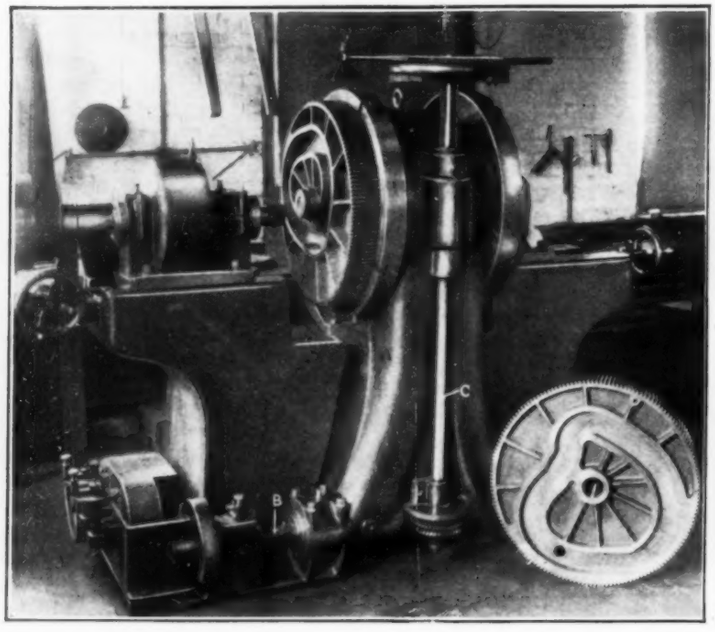


Fig. 1.

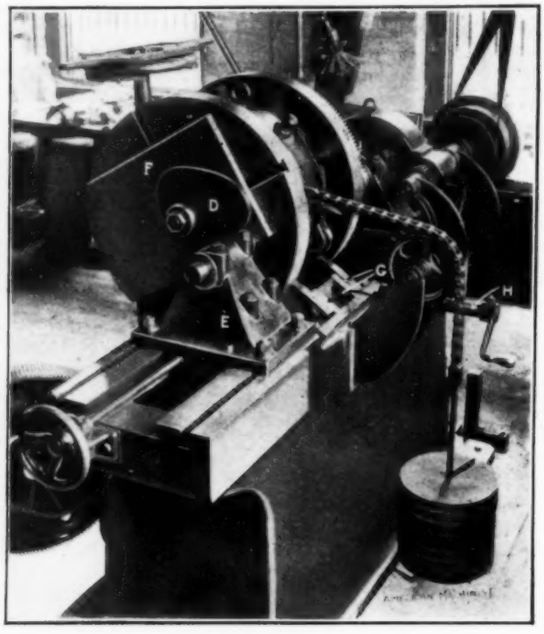


Fig. 2.

Face Cam-cutting Machine

Drum Cam Cutter

The machine in Figs. 3 and 4 is for milling drum or barrel cams. As with the other machine, there are six cutter speeds and nine feeds for each of these.

The master cam and the work are

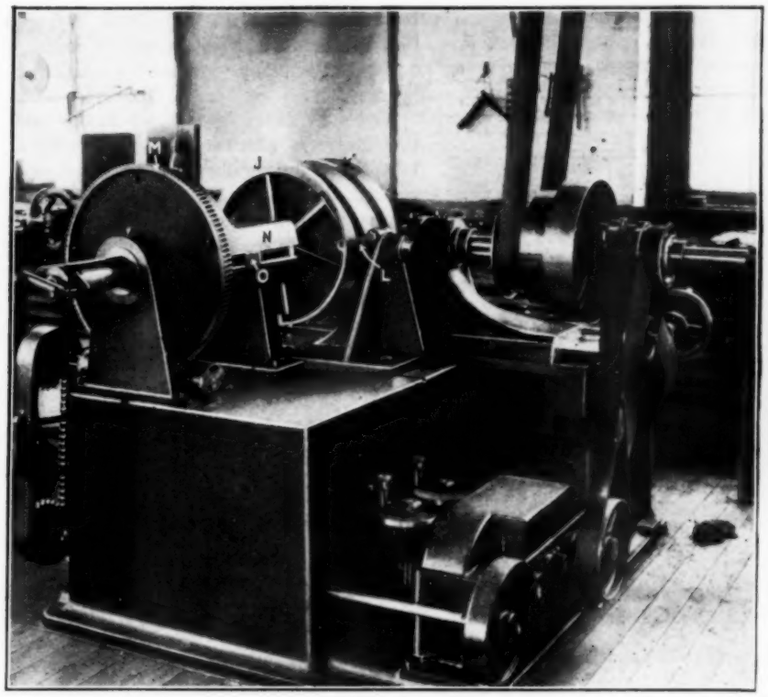


FIG. 3. DRUM OR BARREL CAM-CUTTING MACHINE

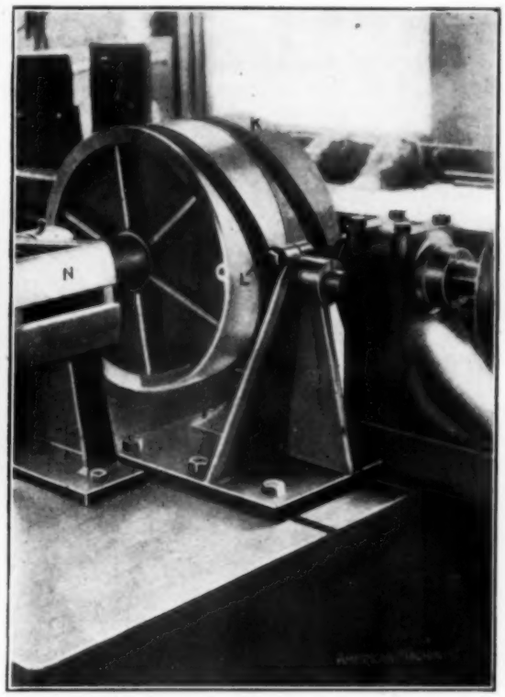


FIG. 4.

placed side by side at *J* and *K*, the guide roll being located at *L*. The worm wheel which does the driving of the work spindle, is secured as at *M* to a yoke *N*, which is slotted through both sides to receive the ends of a crossbar *O* passing through the spindle. This connection gives a steady drive for the spindle and work and allows the spindle to be slid to and fro through the worm-wheel hub by the rotation of the master cam in contact with the fixed guide.

Three cutters are used here also, the first two milling to depth and roughing the sides of the cam slot closely to width, leaving but a light cut for the third mill. The guide roll on this machine is made slightly taper.

Both of the cam cutters were designed and built at the Sigourney shops.

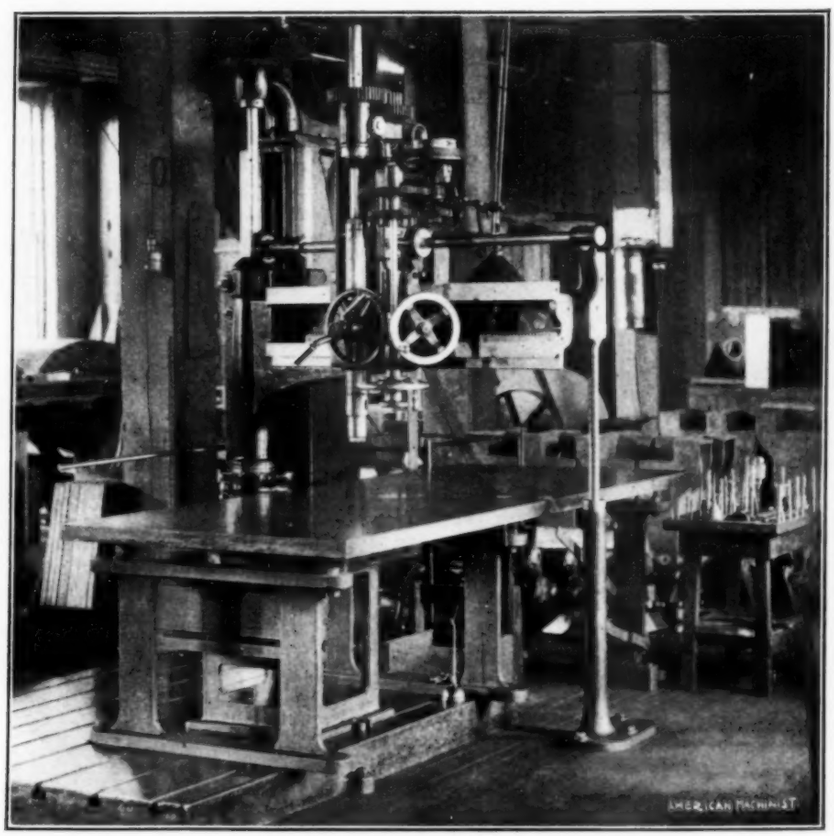


FIG. 5. RADIAL DRILLER WITH LARGE TABLE

HANDLING JIG WORK UNDER THE DRILLER

The radial driller in Fig. 5 is used practically all of the time on fairly large work handled in jigs. The arm may be fixed in the horizontal plane for heavy work by means of the upright at the front of the table, this upright having a flatted head to which the arm is bolted at will. The round nut on the upright forms a medium for adjusting this support vertically when the arm of the driller is required to be elevated or lowered.

The large table is provided especially for holding good-sized frame jigs and other flat work too big to be handled to advantage on the regular table. Whether the machine is used as a regular radial driller or with its arm fixed rigidly, the table is found very convenient for the class of work for which it is intended.

The table is perfectly flat and is kept level by the jack screws under the corners and at the middle, these being tapped into upright frames as indicated.

TOOLS FOR MACHINING SMALL PULLEYS

A set of tools is illustrated in Fig. 6 for machining cone pulleys for sensitive

drillers. These pulleys are handled as follows:

First, they are placed in the turret machine where the bore is chucked out and reamed. Then they are put on an expansion arbor which is carried in the live spindle of a lathe and here both ends are faced off. Next, they are put on an arbor like *A*, Fig. 6, which is placed in the lathe centers, and, with three tools in holder *B*, the steps are turned off. This arbor has a body fitting the bore of the pulley, and a spider with expanding plugs which are pressed by chattering by three steady pins pushed into contact with the casting by the fingers to prevent springing. The locating mandrel is then removed and the interior of the rim is turned out and the inner face of the hub machined with a pair of tools in block *D*.

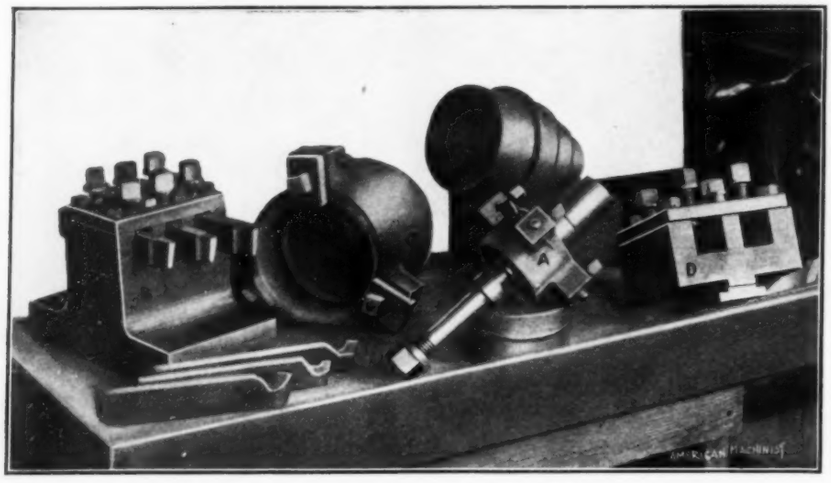


FIG. 6. TOOLS FOR MACHINING CONE PULLEYS FOR SENSITIVE DRILLERS

A regular arbor is used during the crowning operation and the turning of the straight portion at the end of the cone. This arbor is placed between lathe centers and three tools are used in holder *B* for the crowning cuts. The same holder is used with three tools for facing down the edges of the steps. These cuts are all roughed down fairly close to size on the different pulleys in the lot, and then they are finished to size, width of step, etc.

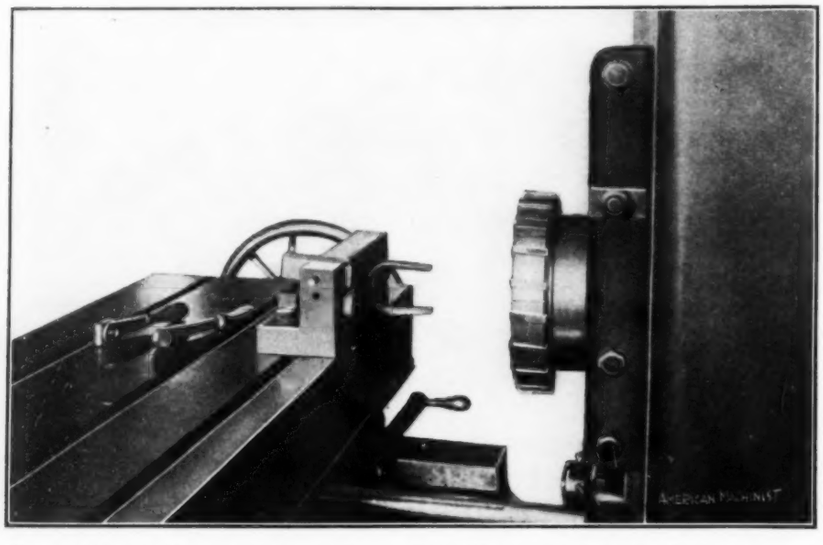


FIG. 7. BORING MACHINE WITH A LARGE FACE MILL AND SPECIAL FIXTURE FOR MILLING

the fingers against the inside of the pulley mouth and then secured by setscrews, to steady the casting during the turning operation.

The turning of the inside of the pulley rim is accomplished by slipping the pulley while on an expanding mandrel, into cat-head chuck *C*, where the work is held central by the mandrel for clamping with the three end straps, and kept from

MILLING OPERATIONS

The Lucas horizontal boring machine in Fig. 7 is employed for a variety of operations in addition to regular boring. It is here shown as fitted with a large face mill and on the table will be noticed a fixture for holding a casting requiring milling across its boss. This piece is a belt-shifter lever for a small driller and the fixture is a substantial block with a seat for centering the work and a single rocker clamp which is actuated by a screw under the outer end to force the gripping surface down upon the boss.

Similar fixtures are in service for a number of similar parts which require facing at one or more points and with the work once adjusted to the cutter the pieces in any lot are put through the milling process rapidly.

Charts for Tool Pressure when Cutting Cast Iron and Steel

BY H. L. SEWARD*

In Volume 28 of the *Transactions* of the American Society of Mechanical Engineers for 1907, F. W. Taylor gives two formulas for the pressure on the tool when cutting cast iron and steel. These formulas are based on the results of a large number of experiments made by Mr. Taylor and recorded by him in his paper on "The Art of Cutting Metals."

If the depth of cut is D and the feed F, the pressure on the tool while cutting steel is given by the formula

$$P = 230{,}000\, D F^{\frac{14}{15}}.$$

If the tool is working in cast iron the formula is

$$P = C D^{\frac{14}{15}} F^{\frac{3}{4}},$$

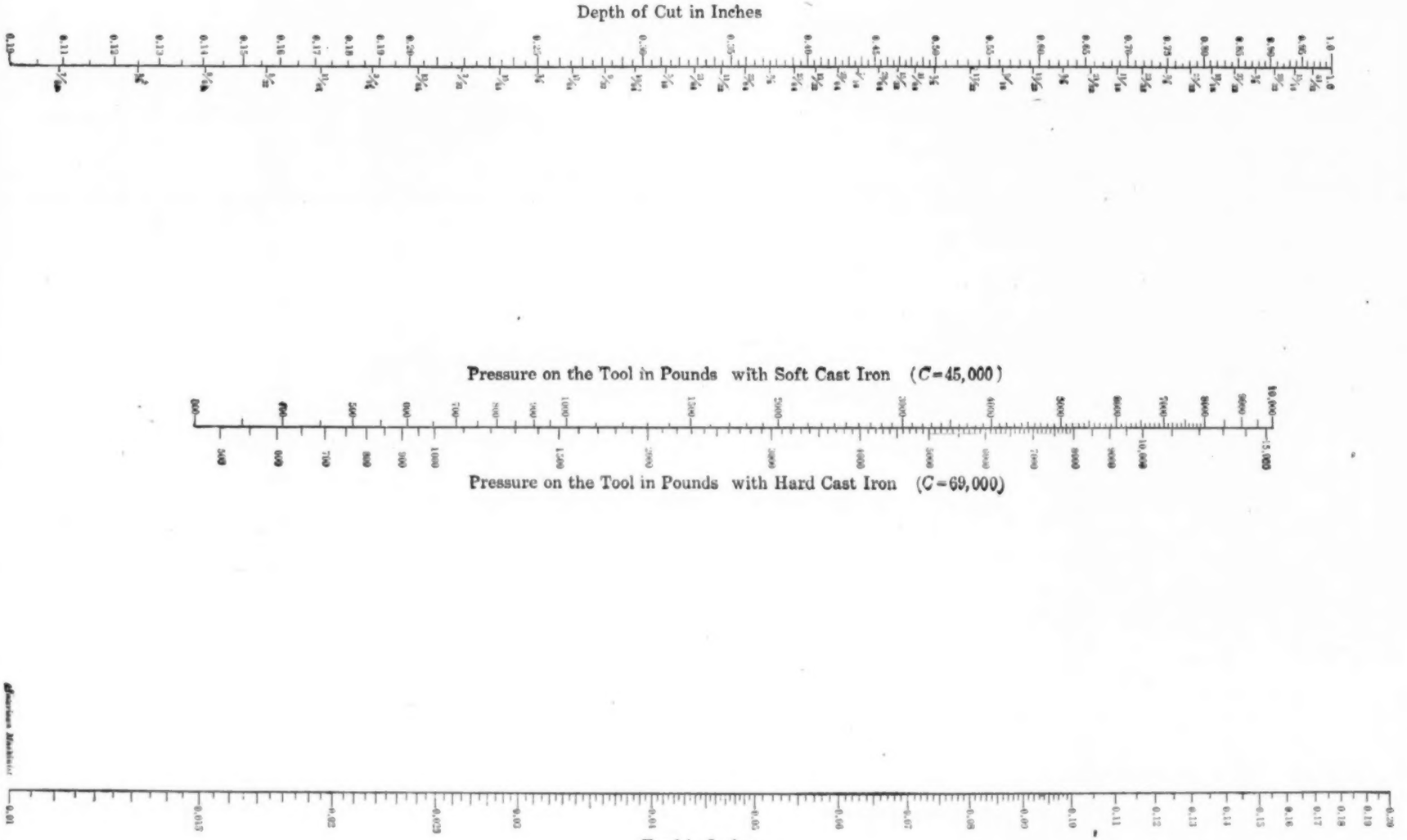
where C varies from 45,000 for soft cast iron to 69,000 for hard cast iron.

The fractional exponents make computation from these formulas rather laborious.

The accompanying charts offer an immediate solution, for it is simply necessary to place a straight-edge or a thread across the three scales from D to F, the outer ones, and read the value P on the middle scale.

By building complete from the raw material to the finished product, in 24 days, one 32x48 simple Corliss engine, weight 176,000 pounds, and one 22-inch, three-high puddle mill, weight 195,000 pounds, the Mesta Machine Company, of Pittsburg, Penn., has succeeded in establishing a record. There was absolutely no stock material on hand for this order and the entire equipment was cast, forged, machined, erected complete and shipped in just 24 days from the date the order was signed. Rapid manufacturing work of this kind seems to be becoming a habit with the Mesta Company, as our readers will recall an illustrated description of a somewhat similar record, published in our columns about two years ago.

*Instructor in mechanical engineering, Sheffield Scientific School.


Depth of Cut in Inches
Pressure on the Tool in Pounds with Soft Cast Iron (C=45,000)
Pressure on the Tool in Pounds with Hard Cast Iron (C=69,000)
Feed in Inches

Explanation: This chart is based on the formula,

$P = C\,D^{\frac{1}{2}}\,F^{\frac{3}{4}}$.

D = Depth of cut in inches,

F = Feed in inches,

C = 45,000 for soft cast iron,

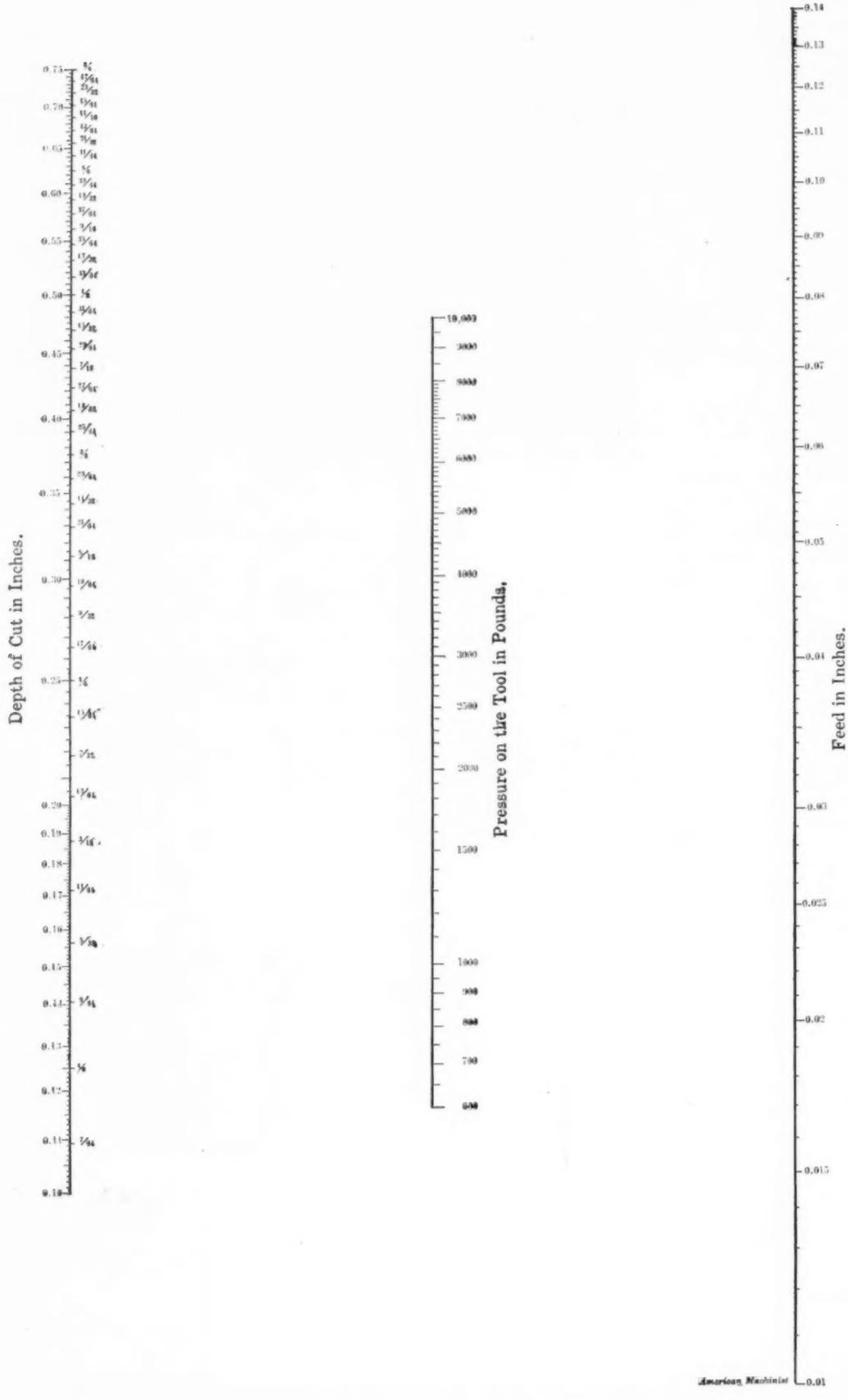
C = 69,000 for hard cast iron,

P = Pressure in pounds.

This formula is given by F. W. Taylor in the *Transactions*, American Society of Mechanical Engineers, Volume 28.

To use the chart place a straight-edge from D and F, and read the corresponding P on the middle scale.

CHART TO DETERMINE PRESSURE ON TOOL WHEN CUTTING CAST IRON. BY HERBERT L. SEWARD



Explanation: This chart is based on the formula,
$P = 230{,}000\ D\ F^{\frac{3}{4}}$.

D = Depth of cut in inches,
F = Feed in inches,
P = Pressure in pounds.

This formula is given by F. W. Taylor in *Transactions*, American Society of Mechanical Engineers, Volume 28.

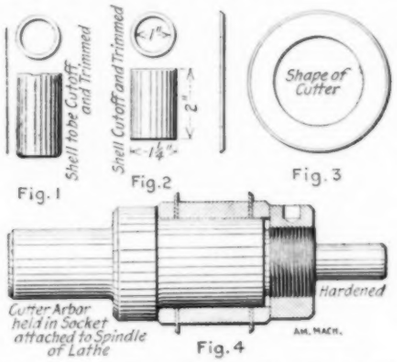
To use the chart place a straight-edge from D and F, and read the corresponding P on the middle scale.

CHART TO DETERMINE PRESSURE ON TOOL WHEN CUTTING STEEL. BY HERBERT L. SEWARD

Trimming Heavy Steel Shells

By M. Martin

These small, heavy steel shells were cut off and trimmed in one operation by a revolving cutter, which had no teeth. Fig. 1 shows the steel shell to be cut off and trimmed. It is 1¼ inches diameter, the walls ⅛ inch thick and when finished was 2 inches long; see Fig. 2. A



The Shell Cutter and Cutter Arbor

cutter, such as shown in Fig. 3, was used to do the trimming, mounted on a special arbor, as shown in Fig. 4. Two cutters were used, one to do the cutting off, the other the trimming, simultaneously. The cutter arbor was secured in a special socket attached to the spindle nose of an old spinning lathe, which was the machine used. The cutters were made of sheet tool steel, 5/64 inch thick, and were beveled to an edge at an angle of 45 degrees, as shown. A large hole was in each, which had much to do with tempering them uniformly. The live end of the cutter arbor was hardened and ground, and ran in a bronze bushing secured in the tailstock of the lathe.

The fixture designed to do the work is shown in Figs. 5 and 6. It consisted mainly of a cast-iron bracket containing two hardened-steel rollers, which turned readily. Figs. 5 and 6, *A* is a cast-iron bracket, the right side being cut away to allow for the putting on and removal of the shell. The left side was full, according to the general outline shown. This bracket had a foot at the bottom, which prevented the bracket from moving backward when pressure was brought against the shell.

The bracket was machined all over, and had two holes drilled through the walls, absolutely parallel with the base and in line with each other, and placed in the position shown, so that the shell to be cut off would rest naturally in a sort of pocket, and would not be pulled out by the cutter striking it. Two hardened and ground steel rollers *B*, ran on bronze pins *C*, which fitted nicely in the holes described above, and were held in position by headless setscrews. A T-slot on the right side of bracket was milled in; in this was the sliding stop gage *E*, which held the shell in position long enough for the cutters to score it, after which it was pushed down and out of the way by the knob on the side. A steel stud, hardened and rounded on the end that came in contact with the shell, was screwed into the sliding piece *E*. On the left side and exactly in the center of the normal position of the shell when resting on the rollers *B*, was an adjusting screw *F*, which was provided with a jam nut to keep it set. At the front end of this screw was a hole in which revolved a hardened-steel stop *G*, which was rounded on the inside end, and came in contact with a hardened-steel button *H*, similar to those used in regular spinning practice. This completed all the details, and the method in which it operated was as follows:

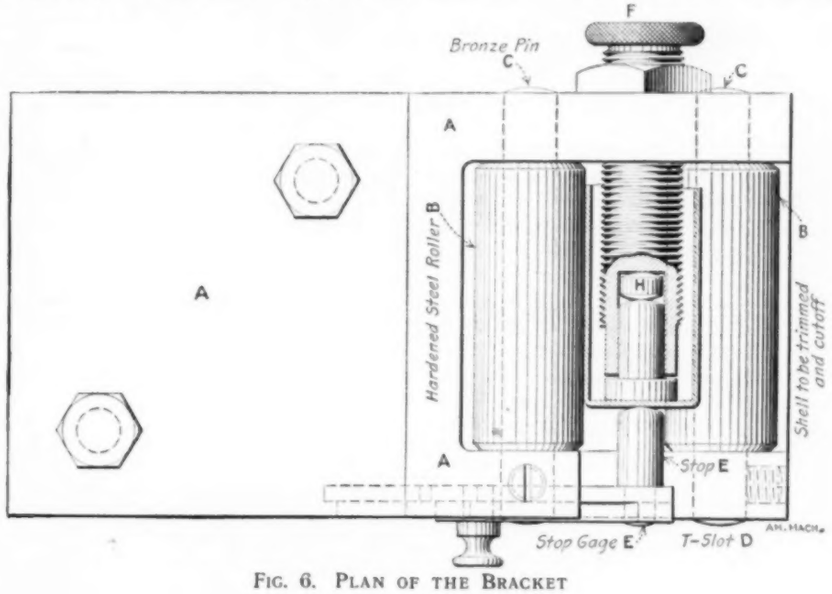


Fig. 6. Plan of the Bracket

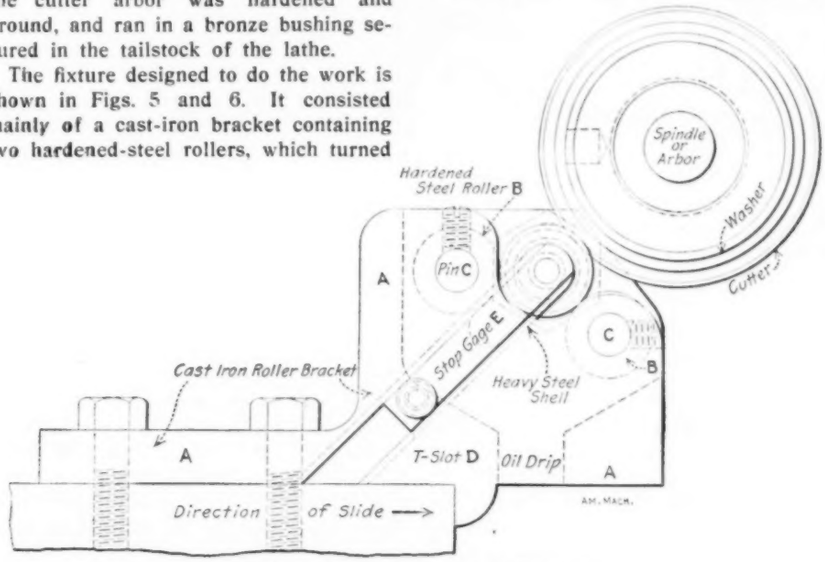


Fig. 5. Side Elevation of the Bracket

The bracket was fastened to the slide of the old spinning lathe, which was set exactly parallel with the spindle. As before stated, this spindle arbor being made special for the job, the cutters were placed the exact distance apart by using a special collar of the exact width, the sharp or high edges of the cutter placed inwardly, as shown on Fig. 4. The operator pushes the sliding stop *E* down and out of the way, and places the shell to be cut off and trimmed between the two rollers *B* and over the adjusting screw *F*, and then pushes the sliding stop *E* up as far as it will go (the exact position of which was carefully determined), which brought the stud on it exactly in the center of the bottom of the shell, when shell was in normal position. The arbor revolving at a fair speed, the bracket containing the roller is brought up by the screw and handwheel of the slide, the cutters come in contact with the shell, causing it to revolve, which in turn causes the two rollers to revolve also. By exerting a uniform pressure against the cutters by means of the screw, and using oil or any other cooling fluid, the ragged open end, and the solid bottom of the shell, are quickly cut off. Before this has advanced too far, the sliding stop *E* is pushed down out of the way. This

was usually done as soon as the cutters had rolled a groove or score in the shell, and insured freedom of the stock contained in the solid bottom in allowing it to move when the cutter, in rolling in deeper, forced the material away. The bottom of this cutoff dropped of its own accord through the opening in the bottom of the bracket, and the cutoff and trimmed shell was readily removed by backing away the slide with the screw.

A New England Shop Restaurant

Owing to the scarcity of suitable and attractive accommodations in the way of restaurants and rooming quarters for employees within reasonable distance of its factory, the Taft-Peirce Manufacturing Company, of Woonsocket, R. I., about a year ago opened a restaurant near its shop in a building which is known as "The Warner," and in which there are also some forty rooms available for lodging purposes.

A NEW ENGLAND SHOP RESTAURANT

This restaurant is open to office and shop employees, and the dining room is finished and furnished in unusually attractive fashion, as will be gathered from an inspection of the accompanying illustration. Another unusual feature is the provision for three meals a day—Sundays as well as week days—for such employees as care to avail themselves of the privilege.

The seating capacity of the restaurant is 175, and the capacity of the kitchen outfit is sufficient for providing meals for 500 persons. The dining room is conducted on the American plan, although there is an *a la carte* service for those who prefer to purchase food at the popular restaurant prices. The service is equal to that of any first-class American-plan dining room, and in fact is the same as found in most good hotels.

The rates charged employees is $4 per week for 21 meals, and $6.50 and $7 per week for room and board. The average number of regular boarders is 75 and the average number of meals served at noon 125.

The Importance of the Organization*

By John Calder

Taking the desire for more economical business administration for granted, consider for a little, in the order of their importance, the various factors which will influence the result.

At the outset we must reckon with the fact that the organization, not the system, is the primary consideration. This is not the order of precedence prescribed by some professional systematizers but any other is a mistake. Every business worthy of the name must be provided with an organization and no matter what particular system may be followed it cannot attain economic distinction if it is not effectively organized.

The primary object of organization is to bring brainy men together for work and action. A wise organization seeks and encourages men of ambition. It believes that the ambitious man is not necessarily dangerous. It knows that success demands an aggregation of strong individualities, free to contribute their quota of wisdom but loyally subordinating their individual preferences to the general policy once declared.

In order that its work may be well done and its action strong and forcible the organization must move forward as a harmonious unit. No amount of clever scheming alone will secure this. Herein lies the task and the genius of the organizer of men as distinguished from the mere systematizer of things. His work is much easier to talk about than to carry out, but it needs brief mention here.

When any business or industrial work becomes larger than its proprietors can take care of, they seek for assistance and from that moment they and their delegate, the general manager, become organizers.

The organizer's success will depend not merely, or even chiefly, upon extended technical experience and close knowledge of the business, but upon his ability to select his assistants, to transfer his own work to them and to inspire those assistants with his own ideas, his own energy, and his own ability.

Emerson says "Every great business is but the lengthened shadow of one man," and he is right.

The modern administrator of industrial establishments is a manager of men rather than of things and the human factor touches his business on all sides. I lay particular stress upon it at this stage, so that it may not get out of focus in an address which is chiefly devoted to an analysis of things.

An organization, therefore, cannot go into commission. It must have a strong, resourceful leader and a carefully selected, well trained, loyal and enthusiastic staff. This will only come through intimate contact with a man, not a mere machine or inanimate system.

Having chosen men, frequently young men, for their record and potentialities, particularly for signs of executive ability, a not too plentiful quality, they should be expected to win solely upon their merits and to make the most of the business by making the most of themselves.

Unless the leader sees and plans for an opportunity for a useful career, not only for himself but for his staff, he cannot reach the highest success.

The cold-bloodedness of some of the modern schemes for exploiting the higher human energies is not only repelling—it is a fatal defect.

*Excerpt from address given before the Engineering Club of Altoona, Penn.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Chasing Threads on a Boring Mill

Not long ago, a job of internal threading, which was too large for any lathe in the shop, came in, and I was given the job of finding some way of doing it. The job consisted in inserting a threaded brass seat in the cast-iron body of a 48-inch gate valve. The brass seat ring was already machined, measuring 50 inches outside diameter, with 1¼ inches of 8-pitch thread, to be fitted to the cast-iron valve body.

The shop has a heavy Betts mill which was large enough to take the work, and a

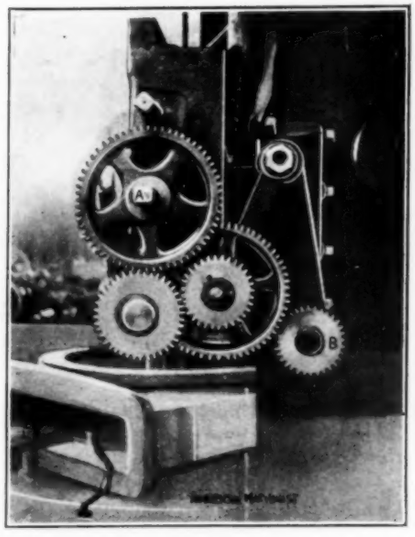


FIG. 1. THE BETTS MILL

train of gears was arranged to make the ram travel at the rate of speed required.

This make of mill has an intermittent feed which moves the ram twice to every revolution of the table. The ram travels ¼ of an inch for one turn of the shaft on which the ratchet pinion is placed. In order to cause the ram to travel ⅛ of an inch per revolution of the table, the shaft marked *A* in the photograph, Fig. 1, must travel one-fourth as fast as the shaft marked *B*. As it was not possible to use simple gearing of the required ratio, compound gearing was arranged so: A 32 pinion on shaft *B* driving a 64-gear on the intermediate, and a 32 on the intermediate driving, through an idler, which was necessary in order to produce a right-hand thread, a 64 on shaft *A*.

As we had only three of the valves to machine, not very much time was allowed for rigging up; hence, change gears from lathes were used entirely, and the pieces used in supporting the idler and the intermediate were odd pieces of rough iron taken from the scrap pile in the blacksmith shop.

After the machine was in readiness, the flange of the valve body was faced, then the bearing for the valve ring faced and bored to the proper diameter for threading. A chalk mark was made on the valve body just opposite the near housing of the mill, with the valve body in a convenient position to insert the seat ring. A piece of sheet copper was sharpened to a point and secured to the ram so that the point would travel over a small scale stuck to the slide close to the ram, as shown at *S*, Fig. 2; the tool was put in place and a good boy installed on the shifter. The first cut was then taken and the mill stopped by means of an improvised brake when the chalk mark on the valve body was opposite the housing. The scale was then moved so that a one-inch graduation came under the copper indicator on the ram. A piece of ½x2-inch iron shaped like an L with a setscrew through one leg of it was clamped to the rail of the mill, as shown at *C*, Fig. 2.

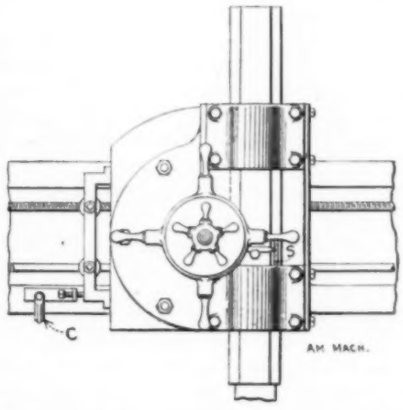


FIG. 2. THE AUXILIARIES ON THE RAM AND RAIL

At the end of the cut, this setscrew was tightened up until it would hold a piece of brown paper between its point and the saddle. The saddle was then fed out, the ram slackened and raised, stopping a little above a ⅛ of an inch graduation and tightened again. The 64 gear was then removed from the shaft *A* and replaced by a crank; the ram was moved down with the crank until the indicator came exactly over the ⅛-inch graduation and the gear replaced. The saddle was then brought up until it touched the setscrew without the brown paper. This gave enough feed for one cut. After the saddle had been brought to place, setscrew was loosened, brown paper inserted again and the setscrew tightened to prepare for the next cut. This process was repeated until thread was finished.

A very good, close-fitting thread resulted, the brass seat ring being screwed in by means of two lugs cast on it for the purpose, and a tool in either head of the mill engaging these lugs. The mill was started up and the seat screwed very firmly into place, after which a cut or two over the top of the brass seat finished the job. While not a very economical way of cutting the thread as far as time was concerned, it served its purpose very well. BEN LANSDOWN.

Glenwood Springs, Colo.

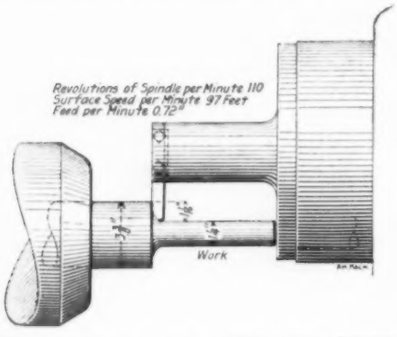
Interesting Job of Turning on the Automatic Screw Machine

The work shown in the drawing is the stem of one of our die holders and the interesting part is this:

The piece was made on a 4¼-inch Cleveland automatic machine and the turning tool, which is fastened against the face of the turret shown on the print, is intended for taking off just such cuts, but generally from larger diameters; in other words, not reducing the piece down to about 1¼ inches. This turning tool is fastened around the stems of the tools in the turret and is intended for taking the scale off of bars before the forming tools do their work, and for turning large diameters to exact size, and where a large amount of stock is to be removed, this tool does the work very satisfactorily.

If a piece has two shoulders, or even three, three tools can be placed in this attachment, and it is the way we have adopted for removing stock instead of trying to use large box mills.

Attention should be called to one thing. It will be noticed that the tool, which is ⅝ square, overhangs the attachment more than 2 inches down to where it is doing its work, and then upon examining the piece it will be seen that it removes a very heavy cut in what would be considered fairly rapid time for an automatic.



A Deep Cut on the Automatic Screw Machine

The small stem is within 0.005 inch of being parallel, even with this heavy cut, and proves that there was only that much spring, or 0.0025 on a side, which shows the rigidity of the machine, as the bar stands out about 10 inches from the chuck hood and the attachment about 6½ inches, making 16½ inches (that is when the tool comes in contact with the bar) from the face of the turret to the chuck hood. There is undoubtedly a certain amount of spring in the tool itself overhanging so far.

As marked on the print we move the turret along at the rate of 0.72 inch per minute, the revolutions being 110. On many jobs with other kinds of tools the feed is much more rapid than this, but in the case shown one must bear in mind the depth of the cut and the bad conditions all around as to overhang, etc.

J. P. Brophy,
Cleveland Automatic Machine Co.
Cleveland, O.

Cutting Threads on the Gisholt Lathe

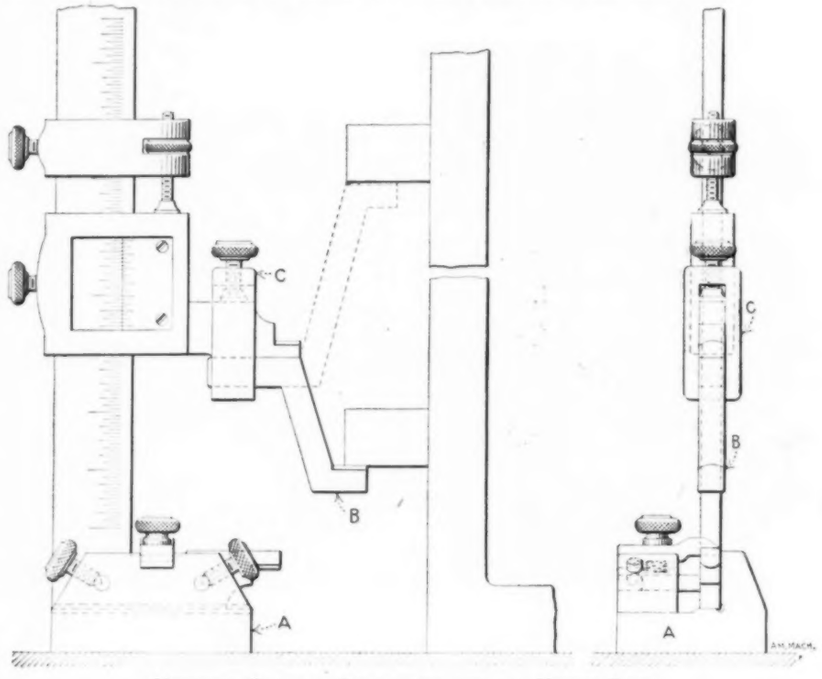
It happens very often, in general machine shops, navy yards, etc., that some threads have to be made on Gisholt lathes where no dies or taps are at hand. The reason may be extraordinary size or pitch. Every Gisholt operator knows how difficult it is cutting a smooth thread on forged-steel or bar work, especially V-threads of coarser pitch. As he cannot move his cutting tool sidewise, it is cutting on both sides at once, thus tearing the thread and getting dull very quickly.

To overcome this difficulty, I took the lock pin from the carriage rest out and ground it about 0.005-0.007 inch thinner, so that it had a little play in the slots. In cutting the thread I let the first cut run as usual. When the second cut is taken, put the ground-off lock pin in and with the handwheel keep the carriage moving ahead. The 0.005-0.007-inch play on the pin allows the carriage about half of one sixty-fourth play and the cutting tool cuts on the front side. The other cuts can be taken in the same way.

Elyria, Ohio. Frank J. Anderla.

Vernier Caliper Converted into a Hight Gage

Most toolmakers take pride in making some of their own tool equipment. To those who own a vernier caliper the attachments illustrated will be of interest. By the use of the entire combination the cost of a hight gage may be saved, provided the requirements of the user are not too exacting.



Vernier Caliper Converted into a Hight Gage

Part *A* is a base which is similar to the base of a hight gage. It is hardened and accurately ground. The little strap and thumb screw hold the vernier down. The two plungers actuated by cone-point thumb screws hold the vernier in a perpendicular position by pushing it firmly against the base.

Part *B* is an extension arm which is to be used in getting very near the layout plate. By inverting these arms as indicated, measurements may be secured that are out of the range of the vernier. Several varieties of arms may be made to suit the conditions.

In setting buttons the measurements are obtained by securing the hight of one button, noting the reading, then the hight of another, and adding or subtracting the readings as the case may require.

Part *C* is a clamp for securing the arms *B*.

It seems advisable not to give the dimensions for these attachments, as the conditions will change with the size of the vernier to be used and the class of work to be measured. The suggestion is enough for most men, if it is anything that will be of any use to them in their work.

Middletown, Conn. S. V. Brook.

Finger Guards for Power Presses

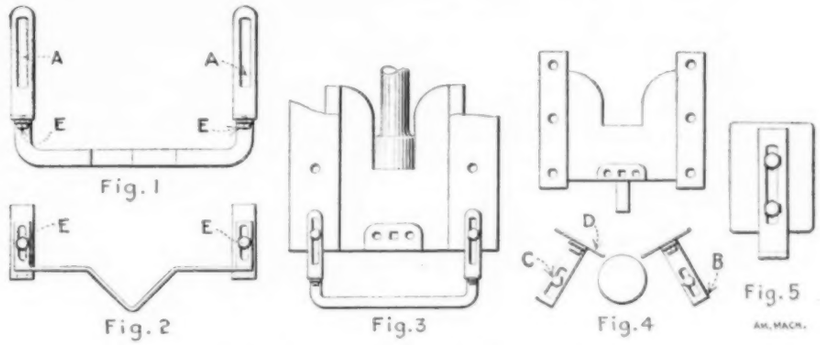
After a long series of accidents to operators' fingers, we were compelled to find some method for preventing such accidents. Safety clutches were fitted to the presses with fairly good results, but still the accidents would occur.

Various stationary and mechanically operated safety appliances and guards were tried with poor results. They usually retarded the production of the work and in some of the designs, when the guard was attached, there was no room for the operator's fingers to grip the stock or strips of metal.

The difficulty to overcome was: First, to construct a finger guard which could be easily attached and detached from the press (as the dies were frequently changed); second, to make it suitable for using either sheet or strip stock without retarding production; third, to use the same guard on various shapes and sizes of dies.

I therefore designed the guard shown in the accompanying sketches. It is cheaply made, simple in construction, easily ad-

justable, and has given excellent results on a number of power presses for the past two years; both in entirely preventing accidents to operators' fingers and also in increasing the production of the work. It also acts as a stripper for stripping scrap metal from the punch, thereby leaving it free for the operator to move forward immediately after the punch leaves the die. Fig. 1 shows the guard complete in elevation, Fig. 2 in plan, and Fig. 3 shows it in position on the press.



FINGER GUARDS FOR POWER PRESSES

It will be readily seen that the guard consists of three main pieces, two L-shaped brackets which are made with vertical and horizontal slots *A* for adjustment, and a crank-shaped piece which is attached to the L-shaped bracket by the small setscrews *E*.

The guard is fastened to the press by the bolts in the press slide as shown in Fig. 3. It can be quickly swung out of the way when changing dies by taking out one of the small setscrews *A* and leaving the other setscrew to act as a pivot for the L-shaped bracket to swing upon.

This method of construction will also be found convenient if it is at any time necessary to take the punch out of the press and replace it again without removing the die.

This particular guard was designed for the cut-and-draw type of press tools, such as are used in the making of tin canisters, etc. But the same principle could be adopted for other dies.

GUARD FOR ANOTHER KIND OF WORK

Another guard which has given very good results in preventing accidents to operators' fingers is the one shown in Figs. 4 and 5. It is for use on the ordinary grooving or seaming press, wherein it is necessary for the operator to place the body of a tin box (or other article) upon a stationary mandrel and hold it in a certain position while a force moves down upon the seam, forces it into a groove in the mandrel and closes it.

Fig. 4 shows the mandrel fixed to the press with the guards attached. Two T-shaped adjustable brackets *B* are fastened to the face of the press frame by the bolts *C* and carry the sheet-steel guard plates *D*, which are adjustable inward or outward according to the length of the mandrel. This guard is easily swung out of the way when changing the mandrels by slackening the bolts *C* and allowing the guards to fall downward. Fig. 5 shows a plan of one of the guards from the under side.

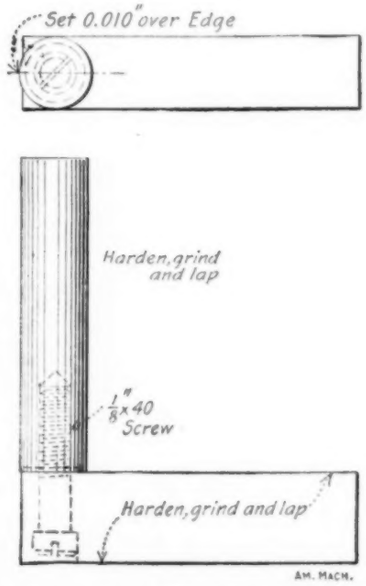
The same pair of brackets and guard plates can be used for a number of different sizes and shapes of mandrels.

Swansea, England. A. WHITBY.

A Square with Cylindrical Blade

Most knife-edge squares must be held parallel with the base, otherwise you do not get a correct reading. With the one illustrated herewith this is not necessary, as you can revolve the square on the work as far as the beam will permit and get a correct reading, providing the beam and the cylinder are parallel.

For extreme accuracy, as on gage work, this square is very useful. The contact point on a cylinder is far superior to the knife edge. It is also simple in construction, and costs about one-half as much to make as others.



A SQUARE WITH CYLINDRICAL BLADE

FRANK KIEFER.

Brooklyn, N. Y.

Placing a Tire under Difficulties

I was interested in the article entitled, "Bushing Car Wheels," for two reasons, because of my admiration for the ingenuity shown in overcoming the difficulty and because it called up memories of a troublesome job of mine.

While in the employ of the Isthmian Canal Commission, on the Canal Zone, we had one day to replace the worn-out tire on the driver of a locomotive.

In our shop we had two benches with a vise to each, a blacksmith forge and anvil at one end, and our one machine tool with its power located at one side.

This tool is unique in itself, it being a rather large post drill, having a hand feed and a crank shaft for operating it. The power consisted of a 6-ft. specimen of Hindoo manhood, strong as an ox, and equal to anything required of him. Our crew consisted of two machinists, and a blacksmith, with several more Hindoo helpers. There were, however, a few other tradesmen of various callings; there were two of each trade needed for the work in hand.

Among other things to be kept in repair were two old French locomotives, used to haul a string of old steel dump cars for transferring the sand from the shovels at the pits to the barges at the pier.

One of these locomotives lost a tire of one wheel, and at such a place as to completely tie up both sand trains. The tire was found to be badly cracked and therefore useless, as we had no welding equipment.

As the tugboat was on its way to Cristobal, we had to wait until it made the trip and came back before we could order a new tire, and then up and back again before we could get to work on it.

In the meantime we got our crew of dark men together and raised the locomotive, laid a track for it and thus cleared the track. We then removed the drivers from beneath the engine after disconnecting both sides, by means of hard work and hand jacks. We laid a platform of ties in the sand and placed drivers on end upon it, building a little higher around it for convenience in working.

After waiting three days and tying up half the sand output of the place, the boat came with several old tires of different internal diameter, and none the proper size. The nearest being about three-sixteenths large, we decided to use shims on the driving wheel. After getting together all the scraps of tin and sheet iron we could find, we brazed them onto

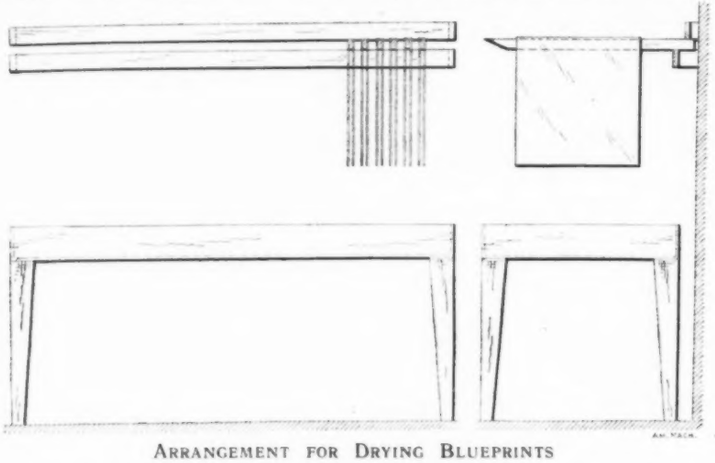
the wheel with a blow torch and brass filings, there being no spelter in the outfit; then we filed the rough spots off as smooth as possible.

We had plenty of black help, and after building a fire in the sand and heating the tire up, had them pick it up with tongs which we luckily had in stock, and placing it in position it cooled there and stayed. The job was not a very neat appearing one, but it answered the purpose.

Montreal, Canada. FRANK ROSE.

Arrangement for Drying Blueprints

The accompanying drawing shows an arrangement for drying blueprints. Two strips were nailed along the wall over



ARRANGEMENT FOR DRYING BLUEPRINTS

the washing tray, the lower strip projecting beyond the upper one. As the blueprints were washed they were taken from the water on the stick and placed between the strips over the tray. The prints can be hung very close together and a large number dried at once. The tray, of course, was supplied with running water.

ARTHUR N. PATTERSON.

Cold Spring, N. Y.

Two Hardening Kinks for the Press Tool Maker

No doubt there are other readers of the AMERICAN MACHINIST, who, like myself, are press-tool makers in a shop where the number of dies made does not warrant the putting down of a special hardening plant or require the services of an expert hardener. Here the toolmaker has to design, make and harden his own tools, with nothing but the open forge or boiler-house fire to heat them in previous to quenching.

As I had been brought up in a large manufacturing firm's press-tool making department where we were not allowed to harden the tools, I found it rather a difficult job to get over the warping which occurred when hardening irregular shaped blanking dies. I tried various experiments, such as dipping or quenching them edgewise, flatwise, cornerwise, etc., but none seemed to have the desired effect which was, to bring the die out of the water so that the templet or gage would fit it practically the same as before the hardening process.

I adopted a method of annealing the die after all machining was done, and finally, when hardening, kept the heat down as low as possible before quenching.

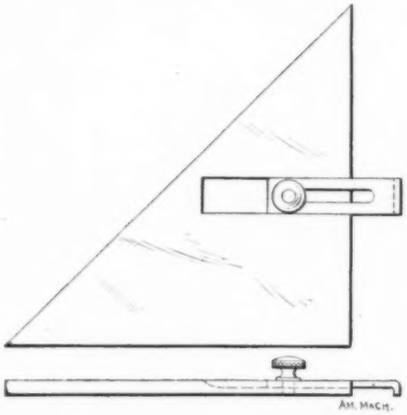
During the above experiments I was often troubled with scale. I found by mixing ordinary, powdered black lead with oil to a thin paste and covering the die lightly before putting into the fire, that the die would come out clean and free from scale. This may, or may not, have any detrimental effects on the steel itself, but as far as I can see it does not appear to leave any bad results.

I also found it a convenient substance to use when annealing intricate parts which were liable to cause trouble if the scale adhered to them, such as screw threads where the screw had to be fitted before the hardening or annealing process.

Birmingham, England. W. ATBEY.

Device for Section Lining

The sketch explains itself. A little device for the 45-degree triangle enables one to draw lines equal spaces apart. As the finger is adjustable for any number of lines per inch, it is a great help in drawing threads of screws. As it is small, it would require only a little room in a draftsman's grip and still do the work of a big, cumbersome and expensive section liner.



A DEVICE FOR SECTION LINING

Philadelphia, Penn. DAN BEENS.

Threading on the Lathe without a Lead Screw

Fig. 1 shows a chuck we had to fit on a homemade gap lathe, which was used as a boring machine. The chuck *A* was

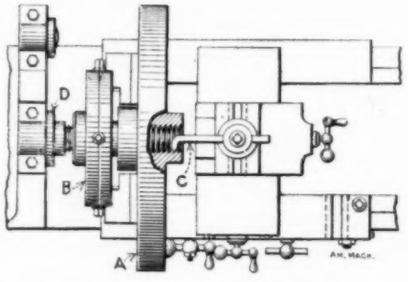


FIG. 1. INTERNAL THREADING

too big to swing in any other machine in the shop, so the job had to be done on the gap lathe itself, and it had no lead screw. The chuck *A* was reversed and placed on the small faceplate *B*, trued up and bored out, the faceplate *B* was loosened on spindle and the cone locked with the back gear in. Then a thread tool *C* was put in and the chuck pulled by hand. As the faceplate *B* came off the spindle *D*, the tool *C* cut thread in chuck *A*. The spindle *D* was 2½ inches from

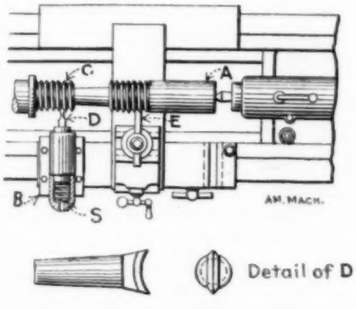


FIG. 2. EXTERNAL THREADING

shoulder to end, pitch of thread 6, the threaded part 1½ inches long. Two shifts were necessary to cut the complete thread on the chuck.

W. B. ODELL.

Birmingham, Alabama.

[We had a somewhat similar job to do many years ago. The job was to make a tap for tapping faceplates for a lathe. The lathe was a very fine one as far as workmanship went, but every screw

thread in it was bastard. The spindle nose was threaded a fractional pitch, which would have taken a train of gears a mile long to cut on any lathe we had in the shop. The tap blank *A*, Fig. 2, was turned with a shank fitting the taper hole in the spindle. The member *B* was a tailstock off a small lathe, whose center hight when mounted on the carriage coincided with that of the spindle *C*. The screw was removed from it and a heavy compression spring *S* put in the barrel behind the spindle. A brass piece *D* was fitted where the tail center usually goes. This was filed to conform to the shape of the thread on *C* and acted as a nut while *C* was the lead screw.

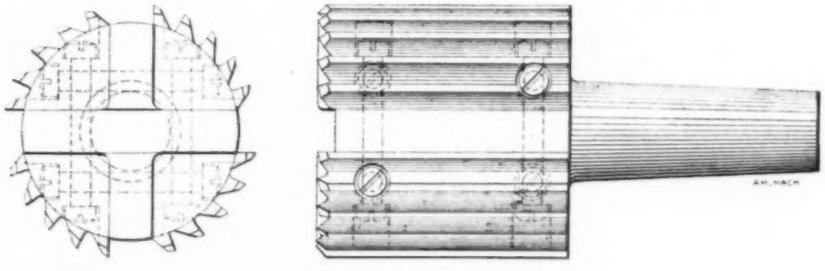
The tool *E* was an ordinary threading tool, held in the tool post.

The slowest speed was used, and a piece of wood under the cone acted as a brake to keep the "nut" *D* from running too far in either direction. After threading one section of *A* equal to the traverse of *D* on *C*, *B* was moved. To do this the spindle was pulled around a quarter turn with the tool *E* in the cut at the extreme right. This was to take up any slight lost motion. The bolts holding *B* to the carriage were then slackened and *B* moved to the extreme left of *C*. With *D* in place in the thread and the spring compressed, *B* was bolted securely to the carriage. The tool *E* was then run back out of the cut and a new section threaded on *A*.—EDITOR.]

An Adjustable Miller Cutter

Herewith is shown a cut of a simple adjustable end mill. We had a job that required slots to be milled on a vertical machine into which boxes were to fit, and the slots were not to vary over 0.001 of an inch. So it can be readily seen that the first time a solid end mill was sharpened it would be small, so this end mill was devised. The body and shank are one piece and milled for four cutter sections which are screwed in place with fillister-head screws, and then fluted, the screw holes, of course, being elongated to allow for end adjustment, and when dull or undersize, shims of tissue paper were inserted.

Cleveland, Ohio. E. KRIEG.

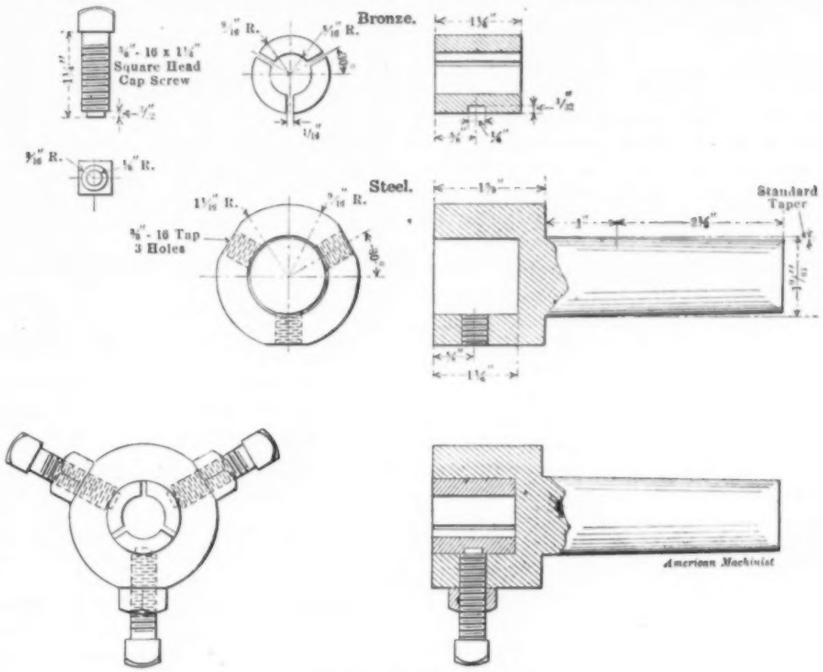


AN ADJUSTABLE MILLING CUTTER

A Three Point Bearing for Lincoln Millers

The bearing illustrated in the accompanying figure overcomes the wear on the end of the shaft and eliminates vibration. It has been used in one of the large factories in Detroit for about six months with a great saving of time and money.

Detroit, Mich. C. P. CHAMBERLIN.



THREE-POINT BEARING

A Ball Bearing Lathe Center

The accompanying drawing shows a center used in a series of manufacturing lathes, in the production of an article which is rough turned previous to grinding.

BALL-BEARING LATHE CENTER

As the operator was required to take care of several machines, the work would sometimes heat and cause trouble. This center was designed to overcome it.

T. CHARLES SCRIBNER.

Hartford, Conn.

Making an Index Plate

Some time ago we had a milling fixture to make, which required an index plate of great accuracy, and precision threads to hold the work in place under a heavy clutch. The index plate, as designed, was 24 inches in diameter, with four index holes near its outer edge, as shown in Fig. 1. The methods we used to space the form holes accurately and bore the locking-pin hole in the fixture to line perfectly with them, may not be new, but I believe they are not commonly used and the successful application of them and the results obtained may be of interest.

When the pattern for the index plate, Fig. 1, was made, the hub was made removable so that a casting could be made exactly like the work, but without the hub. Both the index plate and the extra plate were turned and bored as usual, and care was taken to have the central hole exactly the same size in both cases, and the hub and rims of both in the same plane.

Next, a plain, straight piece *A*, Fig. 4, was made, being turned a close running fit to the central holes in the work; the extra plate and one end were squared up

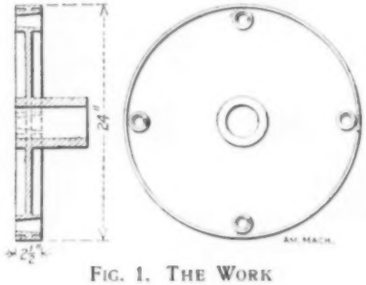


FIG. 1. THE WORK

true with the outside diameter, so that when it was bolted to the machine by bolt *B*, Fig. 4, it would stand straight and square. Also a rough hole was drilled clear through this piece for the bolt.

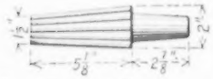


FIG. 2. THE REAMER FIG. 3. THE PLUG

Then a table reamer was made, Fig. 2, to fit the spindle of a Becker-Brainerd vertical miller, and of suitable size and long enough to ream both work and the extra plate, with an inch or more to spare at large end.

Two plugs also were made, Fig. 3, corresponding in size and taper with the reamer, with a nurled handle ground central and true with the taper part. These plugs were to be used in measuring from hole to hole.

The piece *A*, Fig. 4, was bolted to the table of the miller and the index plate, and extra plate put on as shown. The work rested on an extra plate, and the extra plate rested on four parallels *C*, both plates being free to revolve around the stud *A*. The four holes were laid out, the two plates clamped together by the clamp *D*, and drilled and bored as accurately as convenient to a size corresponding with the small end of the table reamer, the record, Table 1, showing that they were nearly 0.007 inch out the first time around.

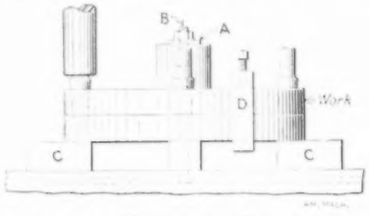


FIG. 4. THE METHOD OF DOING THE WORK

The holes were taper-reamed, the reamer being brought down to a stop, and the smallest diameter of the reamer just coming through the bottom plate. The clamps were loosened and the top plate shifted one hole on the bottom plate (in this case one-fourth of the way around); the two taper plugs were inserted in any two opposite holes, which approximately divided whatever error there might be between these two holes. The holes in the two plates were numbered. The record, Table 1, shows how the errors decreased as the work progressed.

The clamps were now replaced, the plugs removed, and the holes reamed a little deeper, the reamer being brought to a stop as before. The same cycle of operations was repeated until the holes were as accurately spaced as possible. The record, Table 1, shows that 21 times around was necessary to get the required accuracy in this case, the final measuring being done with a pin gage. The error was hardly perceptible to the feeling. The figures in the record are just as they were put down by the toolmaker, the difference between the first two sets and the others being caused by measuring part of the time with outside micrometers and part of the time with inside.

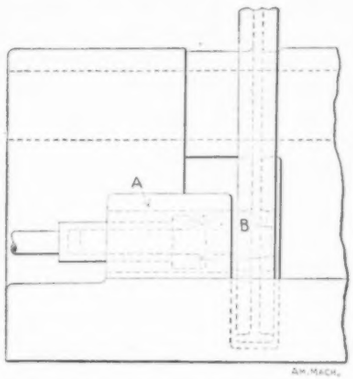
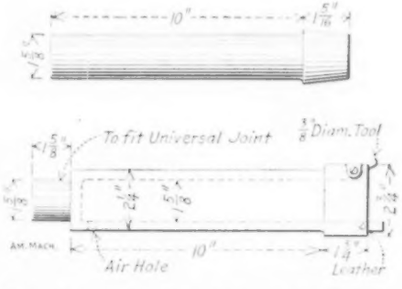


FIG. 5. THE INDEX PLATE IN PLACE WITH ARBOR AND TOOL

1 over 2	1 over 1	1 over 4	1 over 3	1 over 2	1 over 1	1 over 4	1 over 3	1 over 2	1 over 1	1 over 4
1.657	1.656	1.640	1.611	1.6393	1.6387	1.6389	1.6387	1.6389	1.6385	1.6394
2.6565	2.656	2.6397	2.640	2.6391	2.6394	2.6393	2.639	2.6387	2.6386	2.6384
3.6505	3.652	3.6363	3.638	3.6383	3.6382	3.6385	3.6381	3.6386	3.6389	3.6389
4.6565	4.6563	4.640	4.6393	4.6379	4.6389	4.6396	4.6389	4.6386	4.6385	4.6384

1 over 3	1 over 2	1 over 1	1 over 4	1 over 1	1 over 2	1 over 3	1 over 1	1 over 2	1 over 3	
1.6386	1.6384	1.6388	1.6387	1.6379	1.6378	1.6379	1.6382	1.6381	1.6382	
2.6385	2.6383	2.6385	2.6385	2.6379	2.6378	2.6379	2.6382	2.6382	2.6382	
3.6387	3.6387	3.6388	3.6388	3.6383	3.6382	3.6383	3.6383	3.6383	3.6383	
4.6386	4.6382	4.6385	4.6386	4.6379	4.6378	4.6379	4.6381	4.6382	4.6382	

TABLE 1. RECORD OF THE DISTANCES BETWEEN HOLES IN INDEX PLATE.



FIGS. 6 AND 7. THE SLEEVE ARBOR AND THE SLEEVE

After the plate was made the problem was to get the locking pin-hole in the fixture to line perfectly with the hub in the plate. The plate is shown in position in Fig. 5. In the absence of any machine on which we could true up the hole in the plate with the machine spindle and bore pin hole *A*, the following device was made: The sleeve arbor, Fig. 6, was made with a 1⅝-inch shank for the tool sleeve to run on, and a taper turned on one end to fit the taper hole as reamed in the index plate and driven quite tightly into it, as shown at *B*, Fig. 5.

The tool sleeve was bored 1⅝ inches, a close running fit on the sleeve arbor, and a ⅜-inch round tool put in as shown. A small lot was milled back of the tool, and a piece of stiff leather belting was held in with a small screw. This was to sweep off dust and chips, and keep the sleeve arbor clear, as the sleeve advanced.

The back end of the tool sleeve, Fig. 7, was turned to fit a universal joint coupling, and the work was successfully done on an old horizontal boring mill.

The taper holes in the index plate were bushed with straight-hole bushings, and the backing-pin hole with a cast-iron bushing. A straight locking pin was made, and the job was complete.

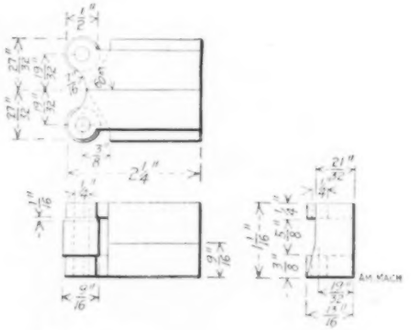
K. H. CRUMRINE.

Windsor, Vt.

Two Part Roller Back Rest for Box Tools

To designers of screw-machine tools the accompanying sketch may offer some suggestion for a roller back rest, adapted to a large range of diameters by making slight changes. While highly efficient, it is also produced without excessive cost.

The rest is laid out for the Warner & Swasey box tool and is made in two parts, each part carrying a hardened-steel roller, running on a hardened-steel pin, both of which are ground after hardening.



TWO-PART ROLLER BACK REST FOR BOX TOOL

The shank of the back rest is fitted to the box-tool holder where the ordinary solid back-rest jaws are regularly used.

F. CHARLES SCRIBNER.

Hartford, Conn.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Standardization of Machine Tools

The paper on this subject, by L. P. Alford, on page 725, appealed to me with considerable force because I have been working along a somewhat similar line with reference to the design of engine lathes; the result of this work I hope to see published in these columns some time. There are some things in the article that I would like to discuss briefly apart from their application to the engine lathe alone.

One of these is the question of interchangeability of chucks, fixtures, etc. It seems to me that certain standards should be agreed upon for threaded fits for such purposes. Not that we should all agree to make the nose of the spindle on all 14-inch lathes the same, but that we should agree that the nose of the spindle on all sizes of lathe should be one of a limited number of sizes, and further that there should be enough difference in size so that a substantial threaded bushing could be inserted in the chuck plate for one size to fit the spindle of the next smaller size. I believe that the tying down of almost any one dimension on any machine to one fixed size makes for limitation of development in design and should be avoided as far as possible. This does not mean that I would wish to see competition set in as to what should be sold for a 14-inch lathe. I deplore the sentiment that prompts men to advertise "Our new and improved 16-inch lathe swinging 20 inches over the vees."

The only excuse for a man's buying a lathe by its length is the same that formerly induced him to buy hangers and shafting by the pound. It gives him the feeling that he is getting a lot for his money. On the other hand, if a lathe should be sold by the distance between centers it is easy to see that a premium is placed immediately on the designer that can pack the driving mechanism into the shortest possible space, which might not be so very bad after all.

Tapers in Machine Tools

Miller builders have pretty well settled on the Brown & Sharpe taper for spindle holes. Lathe builders are just as set on Morse tapers and there are more lathes than millers in use. This gives us the nucleus for a very pretty fight. Of course, there really is no argument for the Morse taper in these days of science, seeing that it is not consistent with itself. Then again we never think of putting a drill shank directly into any machine spindle except a driller. But when we consider that a drill socket may equally well be used in the spindle of either miller, driller or lathe we see an advantage in making them all interchangeable, and right there we find that the humble twist drill seems to have taken the contract to make us use the Morse taper for everything. Of course, there are really no objections to the Morse taper except its lack of consistency. When we consider that every twist drill in the land averages to be in use less than six months it looks as if it would be only a short job to reform the taper of their shanks and make it exactly $\frac{5}{8}$ inch per foot.

Uniformity of tee slots is a matter that is very simple. The maximum-sized tee slot should only be wide enough to take a bolt that one man cannot break with about a two-foot wrench. This is about an inch. This looks ridiculously small for a 30-foot boring mill. But what is the good of a larger one? Anything that goes on a boring mill of that size is apt to be heavy enough so that the puny efforts of a dozen bolts of any size are laughable in comparison to the force of gravity. A comparatively small number of sizes are needed in the list as the limitations of design apply mostly to the depth of the slot, which may be left to be settled by the fancy of the designer.

Feeds and Speeds

Mr. Alford's sixth principle, that of geometrical progression of speeds and feeds I can only half agree with. I realize that I am likely to be in a hopeless minority when I suggest that feeds should be in arithmetical progression. I remember one time I was designing a driller and put on it some eight or ten feeds, all in arithmetical progression. These appeared to me to be right and worked right, but eventually they called forth some pretty tart criticism on the score that if I had known my business I would have arranged them in geometrical progression. I began with a feed of 0.002 inch per revolution. If I made the next feed 0.004 inch per revolution it seemed a natural step, it certainly did not seem necessary to take any smaller step. Using this as a ratio for a geometrical progression I would have had, 0.008, 0.016, 0.032, 0.064, 0.128, 0.256 inch. The last rate would give us a feed of about 9 feet per minute on a $\frac{5}{8}$-inch drill at 70 feet per minute cutting speed. This would be rather out of place. If the upper feed is cut down to a reasonable figure the variation in feeds between those at the beginning of the list is so small as to be foolish, and the variation at the point of maximum production is so large as to make it unlikely that the real point of maximum production will be touched at all.

Geometrical progression fits the case of spindle speeds because it gives the most uniform percentage of error in surface speeds for varying diameters, but we never would have thought of having spindle speeds in geometrical progression if the problem had been one of getting suitable speeds for work all of one diameter but of varying hardness and varying depth of cut.

I agree most heartily with Mr. Alford in his suggestion that nominal sizes of machine tools might well vary in geometrical progression. As things stand today when a firm offers a 48-inch lathe and also a 42-inch it means one of two things, either they are the same lathe with raising blocks cast on the headstock, tailstock and rest, or they are two widely varying patterns, one for a heavy-powered lathe, the other for a light machine. Certainly a user can seldom put his finger on a case where he is justified in calling for any size lathe between 36 inches and 48 inches. Accepting these sizes and applying the ratio between them to a series, we would have the following standard sizes: 9-, 12-, 16-, 20-, 27-, 36-, 48-, 64-, 84-, 108-inch, and 12-foot, which looks logical and ought to make for more profit for somebody, especially among the larger sizes.

Worcester, Mass. E. H. Fish.

A Relieving Attachment

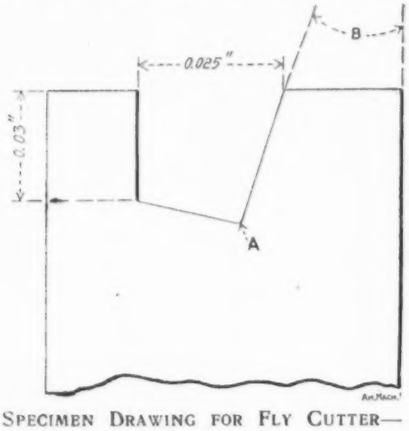
The method described on page 314 under the above title was used for cutting two-toothed cutters here some years ago, only the lead screw of the lathe was used instead of the small cam. The gears were selected to cut 10 threads per inch. This saves the cost of the cam and gives, I should think, just as good results if several light scraping cuts are taken.

It might be interesting to know how the tool for the lathe was made. First of

all a drawing was prepared 20 times the size of the required tool with the radius of the corner *A* exactly marked out, also the angle *D*. These were important. From this drawing a templet was made by placing transparent celluloid over it and following the outline with a sharp knife and dividers (for the radii). This templet or copy was used in the engraving machine.

The tool blank was cut from it by reducing 20 times, using fine cutters for finishing so as to get right into the corner *A*. These cutters had a total angle of 20 degrees, thus giving a 10-degree clearance angle to the tool. By this means an excellent corner was obtained, having a radius of 0.005 inch, the final cutter was about 0.003 inch at the point.

A similar job was the making of small fly cutters to cut the master tool for making gear cutters. A former or templet was made 20 times the size and the fly cutter engraved from it as above. This was used to cut the tool in the miller, which was then sent to the milling cutter



SPECIMEN DRAWING FOR FLY CUTTER—20 TIMES SIZE

makers. The reason for making special cutters was because of the special form required for the job. This method of making the formed tools is very accurate, as it is obvious that a drawing 20 times size can be made correct in every detail.

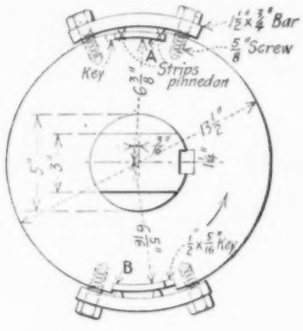
Leicester, Eng. C. A. COPPACH.

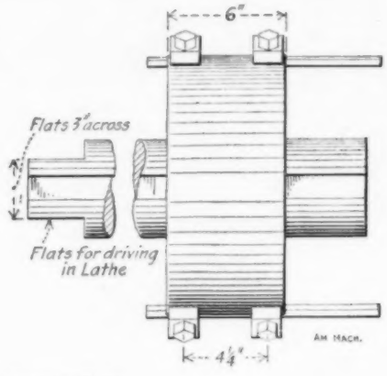
A Trepanning Tool

On page 171, appears a description of a coring cutter, or what is often known as a trepanning tool. For small holes I have no doubt the tool shown will give good results, but for large holes, say around 14 inches in diameter, I think the design would have to be modified.

Recently, I had some 30 connecting rods for large engines to bore out at the crank end to 14 inches in diameter. These were about 9 inches through. The forgings had a 6-inch punched hole, this being of a very irregular shape. These rods were turned, planed, and then marked out for the trepanning operation; the rods afterward being bored to size.

The tool for trepanning is shown in the sketch. A 5-inch bar was used and a trepanning head made from the scrap end of a crank. After being bored, turned, and keywayed, the grooves *A* and *B* were cut on a shaper with a rotary attachment. As will be seen from the sketch these grooves are shaped from a different center to the bore of the head, being $\frac{3}{16}$ inch eccentric;





A TREPANNING TOOL

also the cutters stand at different distances from the center. These are the chief points of difference from your contributor's sketch.

By the method here shown no backing off of the cutters is necessary. These are made of 2½x5/16-inch, high-speed steel, forged to fit the radii of the groove and then padded to this by the tool fitter. They can be of any length and if one breaks it can be ground and again set level with its mate. The one on the larger radius has clearance inward; the one on the smaller radius has clearance outward. They cut a path about ⅛ inch wider than the steel used. This extra width of groove when cutting through a long forging assists the chip to get away and prevents the tools from jamming. Lubrication can also be applied much easier by this method and friction is reduced. Another point in favor of the tool here shown is that the cutters are set with only a small projection when commencing to cut and are extended as the cut gets deeper into the metal.

In addition to the clamps, the cutters are fixed by a key with a slight taper in the direction of the pressure of the cut. These and the clamps are found to hold and no slip of the cutters has been experienced, although fairly coarse feeds are used, coarser than would have been the case with a 4- or 5-inch projection. A tool with such an amount of overhang will have a tendency to spring.

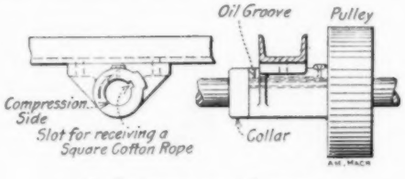
Tools with holes of uneven section through them, as shown in your contributor's drawing, will be liable to crack in hardening; in addition the drilling and shaping of the tools has to be done every time new cutters are required. With high-speed steel this adds considerably to the cost and also limits the depth of cut. The head as shown was used on an old lathe although the idea can be applied to a boring machine, boring mill, or slab miller.

Sandiacre, England. GEORGE HEY.

A Lubricating Device

After reading F. D. Buffum's interesting article on page 27, I made an attempt to apply his device to some bearings for a special purpose. As only a limited space was available it was impossible to design them with lubricating rings. For the same reason Mr. Buffum's device, according to his sketch, could not be made use of because the tops and sides of the bearing come very close to parts of the machine frame.

No doubt Mr. Buffum's proposition to use oil-soaked textile fibers for distributing the lubricant continuously to the surfaces in bearings has a wide field of application. I therefore should like to suggest a mode with which these fibers can be brought in touch with the revolving shaft from below, or from any other direction, according the position of the noncompression side of the bearing.



A LUBRICATING DEVICE

The accompanying illustration shows a journal entirely of cast iron, as often used for textile machinery. The wrought-iron shaft may be held in position by collars, the boss of a pulley, etc. Instead of using cotton waste a square cotton rope is inserted into a square slot on the noncompression side. If oil is poured into the oil hole and spread by the oil groove, this rope gets soaked. If enough is used, not only the inner surface of the bearing, but also the surface of the collars, etc., get provided with an oil film. If no collars are used the ends of the slot may be left open or small covers of sheet iron can be applied for protection.

CONRAD DEUTSCH.

Winterthur, Switzerland.

Industrial Education Convention

Editorial Correspondence

An exceptionally successful convention at which thorough and progressive discussions were presented covering the various phases of the industrial education problem.

The fifth annual convention of the National Society for the Promotion of Industrial Education was held at Cincinnati, Ohio, Nov. 2, 3 and 4, and proved to be the best attended gathering this society has as yet had.

The first session was held Thursday afternoon at the University of Cincinnati, where E. F. Du Brul as chairman extended a welcome on behalf of local educators and manufacturers. He was followed by President Charles W. Dabney, of the University, who outlined its special characteristics and usefulness to the city through its coöperative courses.

Prof. Herman Schneider, dean of the college of engineering, University of Cincinnati, explained the coöperative system of combining practical and theoretical instruction, and J. Howard Renshaw, principal of the continuation school, described the methods of carrying on the work in his branch of the educational system. Another speaker was Principal Johnston, of the Woodward High School, whose subject was the vocational high school. The important phases of educational work dealt with by the three speakers do not require detailing here, as our readers are already familiar with them through various articles which we have published on the different branches of the Cincinnati plan.

The Banquet and Evening Addresses

The banquet at the Sinton on Thursday evening was attended by about 350 delegates, manufacturers and others interested in the purposes of the society. Dr. John M. Withrow acted as toastmaster, and the speech of welcome to the guests was made by Mayor Schwab.

H. E. Miles, of Racine, Wis., spoke on the subject, "How Shall the Obligation to Provide Industrial Education Be Met?" taking the question up from the viewpoint of the manufacturer. He brought out some interesting features of the changing industrial situation, some of the points discussed by him being as follows:

Our exports have been entirely of crude and semi-crude material—the product of mine, forest and farm—with only enough labor in them to make them fit for ship's cargo. Our yearly exportation of highly finished products has amounted to only about one-sixtieth of our total product, only one-fortieth of our total manufactures, and 7 per cent. of total manufactures exported. We have, for instance, been exporting annually $100,000,000 worth of copper in pig and bars rather than $20,000,000 of copper worked up into dynamos and fine hardware to be exported at $150,000,000, after the European fashion. We have shipped steel billets rather than linotype machines. We export cotton at 14 cents a pound with scarcely any labor in it; we buy it back from the thrifty Swiss, in fine handkerchiefs, at $40 a pound, all labor. We have gone about as far as we can in exporting crude materials to be made into finished products by the better educated laborers of competing countries. Impending changes will lower our tariff wall and, in this respect also, bring us nearer the level of international conditions.

For 40 years Germany has had a thoroughgoing system of industrial education. For 25 years it has been intensely practical and satisfactory. It reaches every child upon compulsion. It is more than a coincidence that in these 40 years Germany has risen from a position of great poverty to great wealth. She now annually invests abroad a billion dollars of excess profit. Her teeming factories required and used, last year, the labor of a million operatives from nearby countries supplementing her trained army of efficient workers.

Is it not more than a coincidence that in these same 40 years the United States has had no system of industrial training?

Authorities agree that almost all of the children who enter the industries enter at the age of 14. The working people of the country who wish their children to enter the industries take them out of school at 14, knowing from experience that if they stay in school until 16 they will have passed the psychological time when industry beckons; will have acquired other tastes, and will never enter the industries. The American-born mechanic then is the boy who entered the shop at 14, grown up. Therefore, it is for us to give especial consideration to the educational problem as it concerns children of 14 to 16.

For years the American people have felt the need of industrial education and various schools have been established more or less successfully. For a time we had only the trade school, meaning by this a very expensive plant largely equipped with machinery and teaching a very few boys a very few trades, with admission refused to children under 16, and often refused to children who are not graduates of either the elementary or the high schools. It seemed easier for some communities to spend $150,000 on a school and rest with that expense and such partial fulfilment of the community obligation, than to work out, by the study of other systems, a school that should teach, not four industries, but all the industries, and teach them, not to a few of the children, but to all of the children.

Advance Made by Certain States

After stating that the time is ripe for action Mr. Miles referred to the start made by Massachusetts, and the work now being done in Wisconsin for industrial education. He explained in detail the new child-labor law of that State, which we need not refer to more fully here as it was published with the new apprenticeship laws, in an account of industrial education in Wisconsin, which appeared in these columns at page 547.

Other speakers of the evening were James P. Munroe, of Boston, president of the national society; F. A. Geier, Cincinnati, vice-president of the society; Frank Duffy, of the United Brotherhood of Carpenters and Joiners of America. Mr. Munroe called attention to the lack of coördination, especially in manufacturing communities, between the real needs of those communities and the work of the public schools. Pointing out that the social organism spends, in one way or another, at least $4000 on every child who reaches the age of 18, that this means a potential increment each year in the working capital of the United States of four billion dollars.

Referring to the obligation of public education—since it is practically a monopoly—to give every boy and girl as far as possible the kind and amount of education which that particular child ought to have, Mr. Munroe asserted that what the community wants as the result of schooling is efficiency.

He asserted that it is a social crime to set a boy adrift at 14 or 16 without having given him those fundamental powers which shall permit him to become at majority not only self-supporting, but able to marry and rear in decency a family.

Friday Morning Session

The Friday morning session was held in the new home of the Ohio Mechanics Institute, with Carroll G. Pearse, superintendent of schools, Milwaukee, in the chair. John L. Shearer, president of the institute, gave an interesting account of the history and efforts of the institution, and then the topic for the morning's discussion, "What Types of Continuation Schools Are Most Needed in American Conditions," was taken up, first by Arthur L. Williston, principal Wentworth Institute, Boston, who, after the statement that

many different types of schools are needed to meet all requirements, devoted his paper largely to a consideration of evening schools.

Merits of Evening Schools

Mr. Williston stated among other things in his paper, that comparatively few boys who wish to learn a trade can sacrifice their earning power long enough to attend a full-time, day, trade school. Corporation schools, where it is possible to establish them, have many advantages, but only large corporations are likely to have a sufficient number of apprentice boys in any particular line to make it worth while to pay for systematic instruction. Half-time schools are also excellent, but the difficulties in the way of establishing them on a sufficiently comprehensive scale to provide for any large proportion of the young workers who need training are great. Day continuation schools, for which boys are excused by their employers for a limited number of hours per week, are more possible of general application than either of the other types of schools just mentioned, but only a small proportion of young men who are anxious to receive help can hope to have their work so arranged as to make it possible for them to attend. For the great majority of boys who are ambitious to forge ahead, therefore, the evening school is at the present time, and is likely to remain for many years to come, the most available aid.

The evening hours, after the day's work is done, is the only time which most young men may call their own. This time they may utilize for recreation or enjoyment, or they may utilize it for self-improvement and systematic study. In every city and town of considerable size there are many individuals whose ambition prompts them to use it in the latter way. And it is for the public interest just as much as it is for their own interest that generous opportunity should be provided for them to do so. It is the aim of the evening school to reach out a helping hand to this type of ambitious youth, who is anxious to advance in his chosen line faster than the rank and file, or who hopes to equip himself for some position of greater importance than that which he now holds.

Doctor McCarthy, of Milwaukee, who was on the program to speak upon the "Part Time School" was unable to be present. During the discussion following the paper by Mr. Williston which was taken part in by a number, State Superintendent Carey, of the Wisconsin public schools, referred to the fact that it is very hard for many children to attend evening schools and that it was questionable if the State could justly compel attendance at night classes upon the part of all children not going to day schools. At the same time it was recognized that in many instances the night school was a moral as well as a mental benefit to many young persons who otherwise would be devoting much of their time evenings to questionable and even harmful amusements and habits.

Report of Committee on National Legislation

An important feature of this session was the presentation of the report of the committee on national legislation. This report was submitted by Dr. David Sneddon, commissioner of education for Massachussets, and chairman of the committee.

This committee has had under consideration for several months and has made a thorough study of the provisions of the Page bill, now before the United States Senate, which provides for the annual appropriation of several millions of dollars from the national treasury, in coöperating with the individual States in encouraging industrial, household arts and agricultural education.

While certain features of the measure were reported by the committee as not all that could be desired from the point of view of those interested in promoting industrial education as something distinct from agricultural or experimental station work, it was found on the whole, to be worthy of the society's support in the view of the committee.

This report was taken under consideration, and at the business meeting Saturday morning, it was adopted by the society as expressing its desire to have the bill enacted into legislation, and thus secure federal backing for industrial education.

Afternoon Session

The Friday afternoon session at the Woodward High School was presided over by Miss Edith Campbell, of Cincinnati, who is directress of the Schmidlapp fund for the education of girls, and in charge of the Cincinnati Vocation Bureau. She introduced as the first speaker C. A. Prosser, deputy commissioner of education for Massachusetts, who, in connection with the subject for the afternoon, "What Can be Done for the Factory Worker through Industrial Education," stated that many believe that for the worker who is constantly employed at monotonous or automatic tasks calling into activity only the "habit cells" of the brain, recreation agencies, such as social gatherings, the moving-picture show, the public dance hall, properly regulated, the theater, games and other amusements should be provided which will stimulate thought and palliate the physical and mental effect of his daily employment.

For the male factory worker, the way out may be training for greater efficiency in his skilled calling resulting in better wage, promotion and leadership; or training away from his unskilled calling toward a skilled calling, resulting in a change to a better job; or training in the elementary school branches in which he is deficient, resulting in greater civic and economic intelligence; or training in general high-school subjects, resulting in self-improvement and civic leadership; or recreation and amusement, relieving the worker from the strain of his work and stimulating the brain areas lying dormant during his daily toil. These same paths would be open to the female worker, but in her case each way out would be paralleled by another giving training in the household arts leading to efficiency in the home. The comparatively short period which the female wage earner spends as a producer in the industry, makes it necessary that careful consideration should be given to the social and economic value of any scheme of after-training fitting her for the demands of trade and that every such scheme should offer as one path to happiness and efficiency, preparation for the duties of wife and mother and home maker.

A Psychologist's Work in Cincinnati

Upon the conclusion of Mr. Prosser's paper, Mrs. Helen Thompson Wooley, of Cincinnati, a leading worker in vocational education for children ,and a widely known psychologist, gave a very entertaining account of the methods now being applied in Cincinnati to get some definite clue as to the vocation that a boy or girl leaving school to engage in industry will be most likely to take up with least difficulty. She described the tests made to determine the rapidity of muscular action, the correlation of the movements of the muscles, cleverness of the fingers, quickness of mental perception, etc., the results of these tests coupled with examination of physical characteristics forming a fairly accurate guide by which the vocational bureau can determine whether the applicant looking for employment will be best suited to this or that occupation.

Another speaker of the afternoon was Miss Alida Lattimore, of the employment bureau of H. Black Company, Cleveland.

Economic Value of Industrial Education

On Friday evening the society met at the Hotel Sinton to consider the topic, "Industrial Education Necessary to the Development of the United States." F. A. Geier, of the Cincinnati Milling Machine Company, presided, and the first speaker was F. E. Schwedtman, president of the Citizens' Industrial Association of St. Louis. He presented in his paper many interesting data pertaining to the economic value of both skilled and untrained labor, and referred to the relatively small number of persons receiving industrial education in this country, as compared with the hundreds of thousands attending schools for industrial training in Ger-

many. Following are excerpts from his remarks:

Other nations, notably Germany, have pointed out the way we must follow. The little kingdom of Prussia, with approximately one-third of the population of the United States and one-thirtieth its area, had 400,000 young people between the ages of 14 and 18 attend schools for industrial training during the year 1908. This is equal to 13½ per cent. of the total population. Compare with this the record of the United States Bureau of Education for 1906, which shows that 1¼ per cent. of our population received vocational school education between the ages of 12 and 22 years, and we have the explanation for the more rapid increase of Prussia in export of manufactured goods, notwithstanding our marvelous growth in population and in territory occupied.

The United States with a population three times that of Prussia, should educate three times the number of mechanics, foremen and master mechanics which are educated in Prussia. Of the total—400,000 young people attending vocational training in Prussia, approximately 360,000 are trained as skilled workers, and approximately 40,000 skilled workers are being trained as foremen, master mechanics and engineers. Proportionately, we in the United States should have $3 \times 360{,}000$, or 1,080,000, young people attend vocational training, and $3 \times 40{,}000$, or 120,000, skilled workers should be attending schools to fill places as foremen, master mechanics and engineers.

It has been found that the life earnings of a properly trained mechanic are $20,073 greater than those of the untrained laborer, or $10,531 greater than the life's earnings of the boy who picks up his trade. It would seem that to take an average between the two would be a very conservative estimate of the difference in the life earnings to the American workman which should result from a thorough national system of vocational training. This average is $15,302.

This sum multiplied by 1,080,000, the number of American young people we ought to train constantly, amounts to $16,526,160,000—increased life's earnings to American wage-workers. To reach the annual gain we must divide this sum by 40, which gives us 413 million dollars as the amount which might be added each year to the income of American industrial wage-workers under a proper scheme of industrial education.

At best estimates of this kind must be more or less guesswork, but it is reasonable to believe that if instead of exporting pig iron, steel billets and raw cotton, we should add to it skilled labor to the extent of 413 million dollars per year and export more sewing machines, dynamos and finished cotton goods, we might increase the value of our manufactures two billion dollars per year.

Mr. Schwedtman expressed the opinion that while the continuation school had proved the most effective means abroad for solving the problem of industrial training, he did not consider it the only method that should be followed in this country.

Mr. Schwedtman was followed on the program by E. G. Cooley, formerly superintendent of schools, Chicago. Like the speaker who preceded him he has had an opportunity of thoroughly investigating industrial conditions abroad and he presented an amazing array of figures showing the growth of all lines of industry in the German Empire during the past decade or two.

John B. Frey, Editor *International Molders' Journal*, also entered into the discussion, and called attention to the fact that organized labor is definitely committed in favor of industrial education, but that it never has looked with any marked degree of favor upon trade schools, believing that there is no form of education which can be made a substitute for actual apprenticeship, and that the trade schools offer the most unsatisfactory form of that education necessary to supplement apprenticeship for the production of competent mechanics. He further said that what they favor is a system of continuation schools which will enable the apprentice while serving his apprenticeship to acquire manual dexterity and also acquire a knowledge of the technical departments of his trade which he cannot secure in the shop where he is employed.

The Final Session

The last session, that of Saturday morning, was held at the Sinton, with James P. Munroe, chairman of the society, as chairman. The topic for discussion was: "Should Trade Schools for Youths above Sixteen Years of Age be Provided at Public Expense?"

Carroll G. Pearse, superintendent of public schools, Milwaukee, presented a paper on the affirmative side of the question, in which he stated that If we, as a nation, are to conquer new markets, and win greater success in old markets, we must add preëminent skill of hand and artistic judgment and taste on the part of the worker to our already proved preeminence in the invention and adaptation of labor-saving machinery.

Boys and girls cannot now find opportunities to enter upon apprenticeships as in a former generation; the present organization both of handicrafts and of establishments in which skilled craftsmen are used, is such that fewer and fewer apprentices are taken; fewer and fewer boys and girls can learn trades in the old-fashioned way.

The organization of industry is such that it is increasingly difficult for young persons to learn all of a trade. The temptation is, constantly, to put the apprentice at a single process or portion of the work and there hold him to get the advantage of his acquired dexterity in the one process, or the few parts of the work he can most quickly learn to do at a commercial profit.

For each of these three reasons, trade schools at public expense are of vital importance to the public and warrant the public in paying for them. In such a school the product is the boy, not the manufactured article he makes. He learns better than in any shop, for he is taught, for the purpose of developing the best mechanic. He has, too, the aid and training of the best teachers; he is not dependent on the casual instruction given by a fellow workman, who may himself be only half skilled, or upon the occasional suggestions made by a foreman, who may or may not be intelligent and have teaching ability; who may or may not have any interest in turning the boy into a good mechanic.

These things mean a higher standard of living in the homes of the people; a higher quality of workers, and a higher standard of citizenship. And such an expenditure as will bring these results is a good investment of public funds.

Another View of the Question

In taking the negative side of the proposition, G. M. Forbes, president of the Rochester board of education, said that a 10-year period of study of the industrial conditions and needs of the community is the shortest that can furnish data for permanent conclusions. This must be a period of adjustments to industrial conditions and of corresponding shaping of school organization to meet the demands of both the boy and the industry without sacrificing the essential interests of either. Under these circumstances, it is easy to infer the inevitable attitude of the community toward the proposition to establish a trade school for youth above 16 at public expense. The answer is that the much more urgent problem of shop schools for youth under 16 at public expense has the right of way, and is as yet only in the first stages of solution.

A general discussion that followed Mr. Forbes' paper closed the regular sessions of the society, and the business meeting was then held.

New Officers

The officers for the coming year are: President, W. C. Redfield, American Blower Company, New York; Vice-President, Howell Cheney, Cheney Brothers, South Manchester, Conn.; Treasurer, Frederick B. Pratt, Pratt Institute, Brooklyn.

A jet of compressed air directed against the heated ends of work that is being forged will revive the heat and also blow off all dirt and scale.

Overcoming Bothersome Shadows

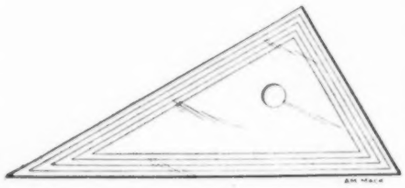
By J. Rollinson

One of the trying things a draftsman comes against is the effect of shadows cast by the set square. This is due, of course, to the direction from which the light comes, whether it be daylight or artificial.

I have read of some drawing offices where the lighting was so arranged that no shadows were cast. Up to now I have not had the pleasure of working in such an office; consequently I have suffered from the annoyance of shadows.

The worst case I know is, when working on some part of a drawing where the lines are all inclined at some angle not obtained by the T-square and standard set-squares, and when one depends upon two set squares only. Then one has to be constantly getting the correct angle by setting up to a line already drawn. If working away from the direction of the light, it is very difficult to get the edge of the set-square exactly on the line, because the line is in the shadow cast by the set-square. To overcome this, I use celluloid set-squares, and I have scribed on them lines parallel to the edges, as shown in the sketch.

When setting to an existing line, I get one of the lines on the set-square directly



How the Lines Were Drawn

over the line on the drawing without any shadow troubles whatever.

It is more accurate and quicker in all cases, and especially so when the edge of the set-square casts a shadow which obscures the line. I extended the wrinkle and drew several lines parallel to the edge of the square and each 1/16 inch apart. These lines act as a continuous rule all around the set-square and save me quite a lot of spring-bow divider work.

If I have set to a line and require another line ⅛ inch away from, and parallel to it, I simply place the second line from the edge of the square over the one drawn and draw the new line in the ordinary way.

For lines 1/16 inch, ⅛ inch, ¼ inch, etc., I place the first, second or fourth line over one drawn, as the case may be. They are also useful for section lining. I scribed them with a sharp marker and filled in the nicks made with india ink. Done this way, they never get rubbed off, and are quite visible.

If buildings in the United States were as fireproof as in Europe, the annual cost of fire losses and protection would be only $90,000,000. New York city spends $10,000,000 a year for fire extinguishment and $15,000 a year for fire prevention.

Elbows

	Center to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	4¼	5	¾	3½	4	⅝
1½″	4½	6	7/16	4½	4	¾
2″	5	6½	½	5	4	¾
2½″	5½	7½	1	5⅞	4	¾
3″	6	8¼	1⅛	6⅝	8	¾
3½″	6½	9	1 1/16	7¼	8	¾
4″	7	10	1⅛	7⅞	8	¾
4½″	7½	10½	1 1/16	8½	8	¾
5″	8	11	1⅛	9½	8	¾
6″	9	12½	1 1/16	10⅝	12	¾
7″	9½	14	1¼	11¼	12	1
8″	10½	15	1⅜	13	12	1
9″	11	16	1⅜	14	12	1¼
10″	12	17½	1⅜	15½	16	1¼
12″	13½	20	2	17⅞	16	1¼
14″	14½	23	2¼	20	20	1¼
15″	15	24	2 5/16	21	20	1⅜
16″	16	26	2¼	22½	20	1⅜
18″	17	28	2⅜	24½	24	1⅜
20″	18½	30½	2⅜	26¾	24	1⅜
22″	20	32½	2⅜	28¼	28	1⅜
24″	22	35	2¾	31¼	28	1⅜

45-Deg. Elbows

	Center to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	2¼	5	¾	3½	4	⅝
1½″	2½	6	7/16	4½	4	¾
2″	3	6½	½	5	4	¾
2½″	3½	7½	1	5⅞	4	¾
3″	3½	8¼	1⅛	6⅝	8	¾
3½″	4	9	1 1/16	7¼	8	¾
4″	4½	10	1⅛	7⅞	8	¾
4½″	4½	10½	1 1/16	8½	8	¾
5″	5	11	1⅛	9½	8	¾
6″	5½	12½	1 1/16	10⅝	12	¾
7″	5½	14	1¼	11¼	12	1
8″	6	15	1⅜	13	12	1
9″	6½	16	1⅜	14	12	1¼
10″	7	17½	1⅜	15½	16	1¼
12″	8	20	2	17⅞	16	1¼
14″	8	23	2¼	20	20	1¼
15″	8½	24	2 5/16	21	20	1⅜
16″	9	26	2¼	22½	20	1⅜
18″	9½	28	2⅜	24½	24	1⅜
20″	10	30½	2⅜	26¾	24	1⅜
22″	10½	32½	2⅜	28¼	28	1⅜
24″	11½	35	2¾	31¼	28	1⅜

Laterals or Y Branches

	Center to Face	Face to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	7½	9½	5	¾	3½	4	⅝
1½″	8½	11	6	7/16	4½	4	¾
2″	9	11½	6½	½	5	4	¾
2½″	10¼	13	7½	1	5⅞	4	¾
3″	11	14	8¼	1⅛	6⅝	8	¾
3½″	12½	15½	9	1 1/16	7¼	8	¾
4″	13½	16½	10	1⅛	7⅞	8	¾
4½″	14½	18	10½	1 1/16	8½	8	¾
5″	15	18½	11	1⅛	9½	8	¾
6″	17½	21½	12½	1 1/16	10⅝	12	¾
7″	18½	23	14	1¼	11¼	12	1
8″	20	25	15	1⅜	13	12	1
9″	21	26	16	1⅜	14	12	1¼
10″	23	28½	17½	1⅜	15½	16	1¼
12″	26½	32½	20	2	17⅞	16	1¼
14″	30	36½	23	2¼	20	20	1¼
15″	31½	38	24	2 5/16	21	20	1⅜
16″	33	40½	26	2¼	22½	20	1⅜
18″	36	44	28	2⅜	24½	24	1⅜
20″	38	46½	30½	2⅜	26¾	24	1⅜
22″	41½	51	32½	2⅜	28¼	28	1⅜
24″	44½	54½	35	2¾	31¼	28	1⅜

Long Turn Elbows

	Center to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	6	5	¾	3½	4	⅝
1½″	6½	6	7/16	4½	4	¾
2″	7	6½	½	5	4	¾
2½″	7½	7½	1	5⅞	4	¾
3″	8	8¼	1⅛	6⅝	8	¾
3½″	9	9	1 1/16	7¼	8	¾
4″	10	10	1⅛	7⅞	8	¾
4½″	11	10½	1 1/16	8½	8	¾
5″	12	11	1⅛	9½	8	¾
6″	13	12½	1 1/16	10⅝	12	¾
7″	14½	14	1¼	11¼	12	1
8″	16	15	1⅜	13	12	1
9″	18	16	1⅜	14	12	1¼
10″	20	17½	1⅜	15½	16	1¼
12″	22	20	2	17⅞	16	1¼
14″	24	23	2¼	20	20	1¼
15″	26	24	2 5/16	21	20	1⅜
16″	28	26	2¼	22½	20	1⅜
18″	30	28	2⅜	24½	24	1⅜
20″	32	30½	2⅜	26¾	24	1⅜
22″	34	32½	2⅜	28¼	28	1⅜
24″	36	35	2¾	31¼	28	1⅜

Tees and Crosses

	Center to Face	Face to Face	Diameter of Flange	Thickness of Flange	Diameter of Bolt Circle	Number of Bolt Holes	Diameter of Bolt Holes
1¼″	4½	8½	5	¾	3½	4	⅝
1½″	4½	9	6	7/16	4½	4	¾
2″	5	10	6½	½	5	4	¾
2½″	5½	11	7½	1	5⅞	4	¾
3″	6	12	8¼	1⅛	6⅝	8	¾
3½″	6½	13	9	1 1/16	7¼	8	¾
4″	7	14	10	1⅛	7⅞	8	¾
4½″	7½	15	10½	1 1/16	8½	8	¾
5″	8	16	11	1⅛	9½	8	¾
6″	9	18	12½	1 1/16	10⅝	12	¾
7″	9½	19	14	1¼	11¼	12	1
8″	10½	21	15	1⅜	13	12	1
9″	11	22	16	1⅜	14	12	1¼
10″	12	24	17½	1⅜	15½	16	1¼
12″	13½	27	20	2	17⅞	16	1¼
14″	14½	29	23	2¼	20	20	1¼
15″	15	30	24	2 5/16	21	20	1⅜
16″	16	32	26	2¼	22½	20	1⅜
18″	17	34	28	2⅜	24½	24	1⅜
20″	18½	37	30½	2⅜	26¾	24	1⅜
22″	20	40	32½	2⅜	28¼	28	1⅜
24″	22	44	35	2¾	31¼	28	1⅜

STEEL FLANGES AND FITTINGS ARE RECOMMENDED FOR SUPERHEATED STEAM

Standard or extra heavy reducing elbows carry same dimensions center to face as regular elbows of largest straight size.

Standard or extra heavy tees, crosses, laterals or Y branches, reducing on run or outlets, carry same dimensions face to face and center to face as largest straight size.

Where long-turn fittings are specified it has reference only to elbows, which are made in two dimensions, to be known as "elbows" and "long-turn elbows," the latter being used only when so specified.

All extra heavy fittings and flanges to have a raised surface 1/16-inch high inside of bolt holes for gasket.

Bolts to be ⅛-inch smaller in diameter than bolt holes.

Size of all fittings scheduled indicates inside diameter of ports.

For O. D. pipe use corresponding size of I. D. fittings.

These dimensions, both standard and extra heavy, refer to either cast iron or cast steel fittings and rolled steel flanges.

DIMENSIONS OF EXTRA HEAVY FLANGED FITTINGS ADOPTED MARCH 13, 1911, BY A COMMITTEE OF THE NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS AND THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. 87 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For October,* 1911 *(American weekly. American monthly, English weekly and German weekly) total,* 94,750.

Of this issue 21,750.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 153

American Machinist

The Revival of Ship Building

In view of the pessimism that has so long prevailed regarding the state of business and of the watch which the daily press is supposed to keep for signs of revivals, to say nothing of the touch which the commercial agencies are supposed to keep of commercial and manufacturing conditions, it is surprising that so little has been said regarding the marked revival which has taken place in the shipbuilding industry.

According to our contemporary, *International Marine Engineering*, from which we have obtained the facts, this revival has already reached a point which promises a state of absolute congestion in the near future. The situation is the more remarkable because no industry has suffered a longer or deeper depression than American shipbuilding, there having been but very few vessels built in this country during the past six or eight years.

During the past three months orders have been placed for no less than 50 vessels of various characters, ranging all the way between tug boats and ocean-going steamships of 10,000 tons, and this apparently is not the end of the story. On the other hand, plans are matured which will call for the building of nearly as many more in number and more than as much more when measured by tonnage. That we are not overdrawing the situation is evident from the fact that several shipbuilders have recently refused to bid on new work or have returned specifications, saying that they could not accept orders calling for delivery within 18 months or two years, and should one-half of the program for additional vessels materialize, it is reasonably certain that our shipyards will be provided with work for about three years to come.

Some of the new work already ordered is the direct outcome of the near completion of the Panama canal, while a still larger proportion of the deferred program hangs on that event, or more properly speaking, on the preliminary awarding of contracts for the transportation of the mail. There can be no doubt that such contracts must be awarded, and there can be as little doubt that much of the deferred program will materialize in the near future.

The change in the situation is as abrupt as it is complete, as it has taken place within the past three months.

We have not sufficient knowledge of the sufficiency of the equipment of the shipyards as regards machine tools to justify a statement regarding the probable demand for them on the part of shipbuilders, but in this respect a word to the wise is always sufficient.

The Shop Restaurant

There are few things more discouraging to a mechanic starting work in a strange town and obliged to "board" or live at restaurants for a more or less extended period, than to find that although the conditions under which he works are as satisfactory as can be expected, he cannot locate suitable or even passable living accommodations.

It is only too often the case that good men who are entirely satisfactory to their employers and who are well suited to the work they are doing cannot be induced to remain in a given locality for the reason that decent and comfortable quarters for eating and sleeping are not available within a reasonable distance of the shop where they are employed.

A good many concerns have settled the problem of the noon-hour meal by establishing shop restaurants to which all employees have access. But, so far as we know, the restaurant illustrated on another page in this issue is the first of its kind to be opened by a machine firm in this country for serving twenty-one meals a week to such of its operatives as care to avail themselves of its facilities.

Visitors to this plant cannot fail to be impressed with the utility and attractiveness of the dining room, and with the completeness of its equipment and service.

The Automobile and the All-around Machinist

We too frequently hear lamentations that the all-around machinist is fast disappearing along with the Maine lobster and the big game of Central Africa. With the purpose of projecting a ray of hope into this melancholy outlook, we would point out that the automobile can number among its virtues the training of all-around mechanics.

The motor car does not always select the large towns, having well equipped machine shops, as a suitable place to break down. Far too often mishaps take place on country roads, where the nearest automobile hospital is a garage and repair shop in some small village. We recently pointed out in these columns that the automobile is a fosterer of the repair shop. In like manner, it is a fosterer of the all-around machinist, for the small repair shop must handle an immense variety of work with a limited equipment. This tends to develop a type of mechanic such as held sway in the machine shops of a generation ago; a type that has been lauded to the skies as all that was needed by way of a machine-shop employee.

Anyone who has had the fortune to watch the repairing of a serious break on a car, as dealt with in some of the best of these small repair shops, cannot fail to have been impressed with the resourcefulness and speed with which the parts were dismantled, the broken pieces mended or replaced and everything put together again ready for the roads.

To be sure, the total number of such men is not large, although it is certainly growing as the automobiles increase in number in our country, and the sections over which they are used broaden out. Each one of these resourceful, skilled mechanics is a valuable unit in the machine-making industry. As pointed out in the first paragraph, their presence should be welcomed as showing a little stemming of the tide, which we have so often been told was carrying all good all-around machinists rapidly into the hereafter. So let us give the devil his due and admit that the automobile in breaking down and wearing out is fostering the training of some skilled mechanics.

Civilian Engineers for the United States Military Service

So many vacancies exist in the grade of second lieutenant in the corps of engineers of the United States Army that some of them are to be filled by civilians. As far as consistent with the interests of the military service, these vacancies are to be filled as usual by promotions from the corps of cadets at the United States Military Academy, but any vacancies remaining after the assignment of cadets of the graduating class in any fiscal year, are to be filled from civil life, as provided by act of Congress, approved Feb. 27, 1911: "To become eligible for examination and appointment a civilian candidate for the appointment as second lieutenant must be an unmarried citizen of the United States between the ages of 21 and 29, who holds a diploma showing graduation in an engineering course, from an approved technical school and is eligible for appointment as a junior engineer under the Engineer Bureau of the War Department. Selection of eligible civilians for appointment, including term of probation, shall be made as the result of such competitive examination into the mental, moral and physical qualifications, and under such rules and regulations as shall be recommended by the chief of engineers and approved by the Secretary of War."

By this act an advantageous field is opened to young engineering graduates. The engineering work carried on by the War Department is of great variety, extending from the highly organized manufacturing of the various arsenals to the tremendous construction work on the Panama canal. The department provides its engineers with the best of living conditions consistent with the surroundings in which they are placed, and opportunities for advancement and promotion, provided the individual establishes a good service record and successfully passes the prescribed examinations.

Undoubtedly many young engineering graduates will avail themselves of this opportunity to enter the Government service, realizing that they will be brought in touch with important work and receive a training that might be difficult to obtain in private enterprises.

The first examination under the act will be held beginning Jan. 12, 1912. An application blank and general orders covering the qualifications of candidates may be obtained by addressing the Adjutant General, United States Army, Washington, D. C.

PERSONALS

Charles D. Young, assistant engineer of motive power, Pennsylvania Railroad Company, has been appointed engineer of tests, with headquarters at Altoona.

Charles D. Chasteney, who has been sales manager of the De Laval Steam Turbine Company, Trenton, N. J., has become connected with the Turbine Equipment Company, New York City.

Walter R. Emig, formerly of the inspection department of the Toledo Computing Scale Company, has become secretary and treasurer of the Toledo Metal Spinning Company, Toledo, Ohio.

S. A. Donaldson, until recently a member of the engineering staff of Westinghouse, Church, Kerr & Co., has joined the mechanical department of the New Jersey Zinc Company, Palmerton, Penn.

C. J. Morrison, who has been holding the position of manager of the department of effective organization, Suffern & Son, New York City, has been made manager of the engineering department of that firm.

Robert C. Monteagle, formerly chief engineer of the Atlantic Works, East Boston, Mass., has accepted a position as assistant manager and engineer of the Lockwood Manufacturing Company, East Boston, Mass.

E. W. Hamilton, mechanical engineer for the past nine years of the Oakville Company, Oakville, Conn., has become connected with Harvey Hubbell, Inc., Bridgeport, Conn., where he will act in a similar capacity.

William Bayard Sturgis, until recently superintendent of the Dover White Marble Company, Wingdale, N. Y., has become acting resident engineer with the E. I. du Pont de Nemours Powder Company, Wilmington, Del.

Bruce W. Benedict, for several years in the motive-power department of the Atchison, Topeka & Santa Fé railway, has been appointed director of the shop laboratories in the department of mechanical engineering at the University of Illinois.

Claude E. Cox has been appointed resident manager of the research department of the General Motors Company, Detroit, Mich. Mr. Cox was formerly factory engineer and factory manager of the H. E. Wilcox Motor Car Company, Minneapolis, Minn.

Charles Eisler, formerly foreman with the Hoefer Manufacturing Company, Freeport, Ill., and recently with the Barber-Colman Company, Rockford, Ill., in the same capacity, has accepted a position as assistant master mechanic of the Metzger Motor Car Company, Detroit, Mich.

Frank L. Sessions has been appointed superintendent of the Standard Welding Company, Cleveland, Ohio. Mr. Sessions formerly conducted a consulting mechanical and electrical engineering practice in Columbus, Ohio. F. H. Meyers, for many years in the employ of this company, has been promoted to the position of assistant superintendent.

T. F. Salter

T. F. Salter, manager of sales and engineering, of the Standard Roller Bearing Company, Philadelphia, Penn., died very suddenly at his home in that city on October 25, at the age of 35. Mr. Salter was a member of the American Society of Mechanical Engineers and the Society of Automobile Engineers.

Daniel Drawbaugh

Daniel Drawbaugh, an inventor of wide reputation, and conspicuous in the early development of telephonic apparatus, died in Harrisburg, Penn., on November 3, aged 84 years.

Early in life Mr. Drawbaugh displayed natural mechanical skill, and his inventive ability resulted in a long line of inventions in various mechanical fields, including the first nail-making machine.

Mr. Drawbaugh's work in the development of telephone apparatus gave him considerable public prominence in the early eighties when his claim as the inventor of the telephone was agitated in connection with patent litigation.

Charles H. Phillips

Charles H. Phillips, for the past 24 years a member of the selling organization of the Brown & Sharpe Manufacturing Company, and widely known throughout the machinery trade of the East, died at his home in Providence, R. I., on November 3, in his seventy-ninth year.

A practical mechanic of the old school, he early in life turned his attention to the iron-working industry in which line, by close application, he rose to the position of foreman and later to that of a successful machinery salesman.

He was born in Taunton, December 26, 1832. After receiving his education in the public schools of Providence he returned to Taunton in 1845 entering the employ of the Mason Machine Company where he served his time as an apprentice machinist. In 1856 he entered the employ of the Brown & Sharpe Manufacturing Company, then known as the firm of J. R. Brown & Sharpe, remaining with this firm for about a year and a half.

During the next nine years he worked in the old Burnside Rifle Works. In 1867 he left to accept a position as contract foreman of the miller department of the Brown & Sharpe Company.

About twenty-four years ago he began his career as a traveling salesman, although still retaining his position as a foreman. His mechanical ability, aided by an engaging personality, won him success in this line of work from the start, and he became a member of the permanent traveling staff. He is survived by four children.

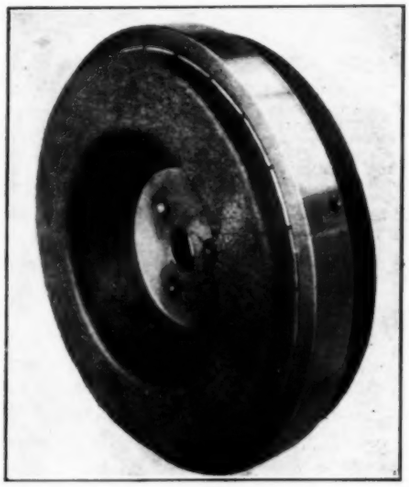
Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Ring Wheel Chuck

The chuck body or shell of the ring-wheel chuck shown herewith is a one-piece steel casting. The outside or clamping ring is a threaded steel forging, and has a taper seat for contracting the periphery of chuck body. The outside of chuck body is tapered and threaded to conform to the taper and thread in the clamping ring. This tapered and threaded portion of the chuck body is slotted in a number of places so that the clamping ring acts on the principle of a spring collet, gripping the abrasive ring evenly at all points. A spanner wrench is all that is necessary to operate it.

When a new abrasive wheel is placed in the chuck it extends one inch beyond the face of the chuck body. As the ring becomes worn down to the face of the chuck body, it is removed and short back-



RING WHEEL CHUCK

ing plugs put in place. As the abrasive ring again wears down, the same procedure is followed, using longer plugs. The chuck body is recessed in the back to reduce overhang.

This ring-wheel chuck is a recent development of the Gardner Machine Company, Beloit, Wis., and is adaptable for use on the various types of grinders.

Cold Metal Sawing Machine

The accompanying halftone shows a recent design of rapid-production crank-shaft sawing machine, which operates two blades at one time.

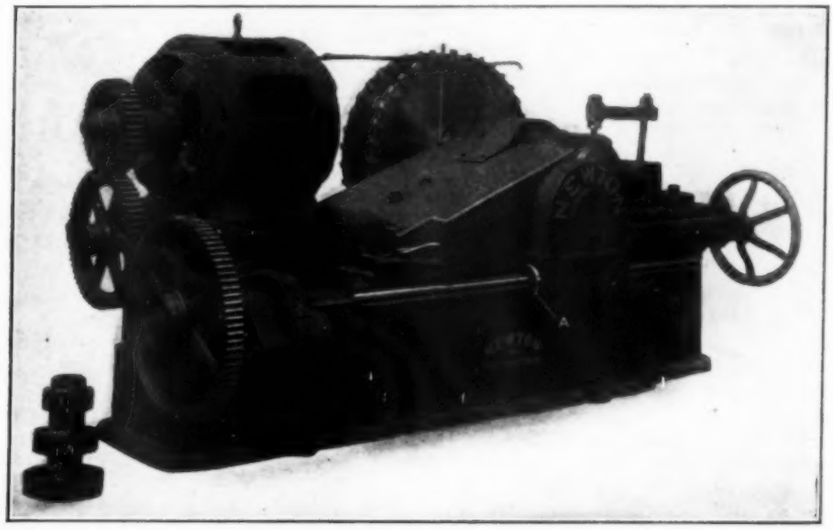
The diameter of the saw blade is 32 inches; capacity for round stock in one cut up to 9½ inches, or for cutting to a depth of 9½ inches in throats of crank shafts. When fitted with a milling cutter, the machine also has capacity for finishing the cheeks of the crank shafts without sawing.

The machine is of the spindle-driven type, spindle revolving in capped bearings and supported on each end, and the driving gear is placed between the bearings. The teeth of the pinion meshing with the spindle gear are cut from the solid, and the driving worm is a solid bronze casting. The worm wheel is of hardened steel fitted with roller thrust bearings, and both are incased for continual lubrication. To prolong the life of this bearing, the spline shaft is fitted with bushings to revolve with the shaft at *A* to prevent the escape of the oil through the splines in the shaft.

The drive has bearings on the pinion shaft so arranged that the pinion will be supported on both sides. To insure constant and positive forward movement of the saddle under the heavy stresses to which the machine is subjected, a gear-feed box has been attached, giving six changes, and in addition there is power quick return. The saddle is fitted with positive and adjustable automatic stops to release the feed and fast traverse at any predetermined point and also to insure the release at the end of the traverse. The drive to the machine is by means of a Reliance 20-horsepower induction motor, running at a speed of 720 revolutions per minute.

To minimize the proportionate error in the fit of the blades to the spindle, the extension to the spindle is made of proportionately large diameter, in this case 8 inches, and the blades are driven by two broad keys. The blades and collars are held in place by a 4-inch diameter hexagon nut. The maximum gap between the blades on this machine is 4 inches and spacing washers are provided, the different combinations of which give variations of 1 inch. All gears are covered and a guard for the blades is provided.

The machine is a recent product of the Newton Machine Tool Works, Philadelphia, Penn.



COLD METAL-SAWING MACHINE

Calorized Electric Soldering Iron

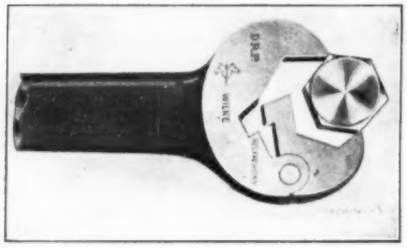
The General Electric Company has developed a process of treating copper soldering bits, which renders the latter nonoxidizable under high heats and non-

corrodable by the acids used in soldering. Further, it reduces to a minimum the dissolving action of the molten tin, with which the working tip must always be kept coated.

This "calorizing" process does not merely coat the surface of the copper with a thin layer of nonoxidizable or noncorrodable substance, but actually changes the characteristics of the copper to an appreciable depth.

Machine Wrench

The accompanying halftone shows a new design of machine wrench, in which the jaw is pivoted as shown, this permitting a grip on five faces of the nut, a design calculated to preclude the possibility of slippage.



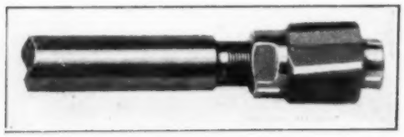
MACHINE WRENCH

The wrench is manufactured in eight sizes by H. Wilke & Co., Remscheid, Germany, of whom Alfred Müller, 2 Rector street, New York City, is the American representative.

High Speed Adjustable Reamer

The design of the adjustable reamer shown herewith is apparent from the halftone.

Two solid blocks of high-speed steel with conical ends are held on the arbor by two collars. There are four left-hand spiral cutting edges milled in the solid head. Adjustment is effected by lowering the rear collar and tightening the front one, which forces the reamer head up the inclined surfaces of the arbor. A 2-inch reamer expands nearly 3/32 inch, and right-hand spiral flutes are furnished if specified.

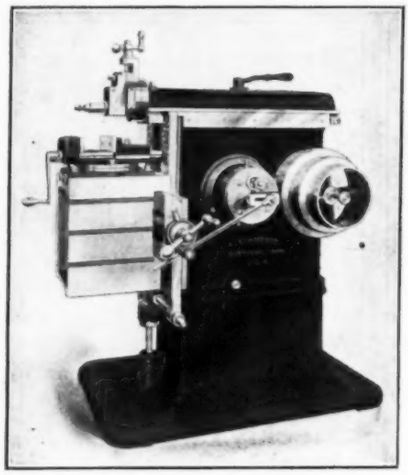


HIGH-SPEED ADJUSTABLE REAMER

This reamer is manufactured by the McCrosky Reamer Company, Meadville, Penn., under the name of Ideal adjustable reamer.

Backed Geared Crank Shaper

The accompanying halftone shows a 12-inch back-geared shaper, recently developed by L. E. Rhodes, Hartford, Conn.



BACK-GEARED CRANK SHAPER

The machine is especially designed for the use of high-speed steel tools, and has six changes of speed; three of a ratio of 5 to 1, and three of a ratio of 10 to 1, the knob in the cone pulley controlling the changes.

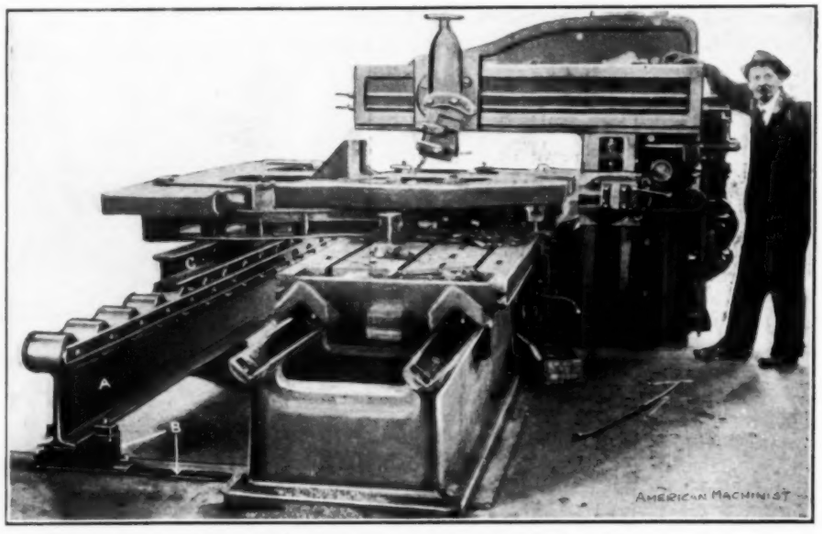
The swivel-base vise has tool-steel faced jaws 9 inches long, 2 inches deep and opening 6 inches. The finest feed is 0.005. The table is fastened to the cross rail by a wedge-shaped gib, insuring a solid bearing surface its whole length

The head is graduated, can be set at any angle, and is fastened to the ram by a positive clamping device.

Overhang Support for Open Side Planer

In the Canadian plant of E. & T. Fairbanks & Co., at Sherbrooke, Quebec, is a roller-bearing support, shown in the accompanying halftone, which is used to hold up the overhang load of large castings, while they are being machined on a Detrick & Harvey open-side planer.

The track *A*, on which the rollers travel, is made of a section of a standard I-beam, planed on the top and carefully set so as to be parallel to and level with the ways of the planer. This I-beam is clamped to brackets, which are in turn bolted to iron T-slots set in concrete, as shown at *B*. Every third roller is flanged to keep the set on the track and also to guide the part *C*, on which the casting rides.



OVERHANG SUPPORT FOR OPEN-SIDE PLANER

To Case-harden and Mottle

BY WILLIAM C. BETZ

Small lots of screws and other steel parts of small size can be case-hardened and mottled at the same time by the following method: Take a small iron ladle or pot and place enough pieces to half fill it, cover over with cyanide of potassium to fill the receptacle two-thirds full; place in an open fire or gas forge and heat to a good cherry red. Hold the heat about twenty minutes for carbonizing one sixty-fourth inch deep. Have a can of clean cold water as close to the forge as possible. When the pieces are in long enough pour all the cyanide out of the ladle into a suitable receptacle. Place the pot and work back in the fire for about five minutes, then dump the contents quickly into the water, taking care to prevent the air from striking it. Be sure that the work and receptacle are clean and use only clean cold water for quenching. After the pieces are taken from the quenching bath, put them in a wire basket and dip this in clean boiling water to bring out the colors more prominently. Remove the pieces and oil them while hot and they will have a nice bright mottle. Where the quantity did not warrant starting a large carbonizing furnace, I have found this a very satisfactory way to case-harden and mottle small pieces.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The Texas Company will erect a garage on Albany street, near Armory street, Springfield, Mass.

G. E. Crawford will build a garage at the corner of North avenue and Pacific street, Bridgeport, Conn.

The garage of Chas. E. Whitten, Central avenue, Lynn, Mass., was badly damaged by fire. Loss, $8000.

Plans have been completed for a two-story garage for L. G. Hoadley, of 39 Church street, New Haven, Conn.

John Haberan will open a new blacksmith shop on New Britain avenue, Unionville, Conn., in the near future.

The Waterbury Brass Company, of Waterbury, Conn., will build a new casting shop at its plant on West Main street.

Kirk & Co., Temple street, New Haven, Conn., has awarded contract for the erection of a $40,000 garage at 215 Crown street.

E. A. Smith, of Providence, R. I., has purchased the property of the Pawtucket (R. I.) Foundry Company and contemplates operating same.

The Taunton-New Bedford Copper Company, New Bedford, Mass., is to expend $250,000 for a new rolling mill in connection with its present plant.

The Underwood Typewriter Company, of Hartford, Conn., will add another new factory building to its present plant, which will be five stories high.

The New London Ship and Engine Company, New London, Conn., will increase its capital from $500,000 to $3,500,000. The plant will be enlarged to four times its present size.

Contract has been awarded for the erection of the new machine shop of the Lamson Consolidated Store Service Company, Lowell, Mass. The building will be four stories high.

The Briggs Magneto Company, Augusta, Me., has been incorporated with $600,000 capital to manufacture electrical apparatus and appliances. Incorporators, L. J. Colman, M. M. Farrer and C. L. Andrews.

The Sun Enamel Works, Leominster, Mass., will build a two-story addition to its plant on Spruce and Whitney streets, same to be used for turning handles and knobs. An addition will also be built to the baking room.

The Pyramid Automobile Company, New Haven, Conn., has incorporated with $50,000 capital to conduct an automobile service line and garage. Incorporators are E. J. Stannard and W. H. Cone, of New Haven, and H. P. Johnson, of East Haven, Conn.

MIDDLE STATES

The Toledo Metal Spining Company, Toledo, Ohio, will want some machinery.

The Illinois Aëroplane Company, Coal City, Ill., has commenced the erection of a plant.

The Benz Motor Car Company, of Cleveland, Ohio, will erect an addition to its plant.

The Aurora (Ill.) Automatic Machinery Company is to erect three additional buildings.

The Aluminum Castings Company, of Detroit, Mich., is erecting an addition to its foundry.

The Manistee & Northeastern railroad, Manistee, Mich., is in the market for drilling machinery.

The Miller Car Company, manufacturer of motor cars, of Detroit, Mich., is erecting a new factory.

The New York Shipbuilding Company, Camden, N. J., has let contracts for a large addition to its plant.

Lippincott & Co. have let contract for a garage at Twenty-fourth and Locust street, Philadelphia, Penn.

Garage of F. B. Fretter, 2581 Norfolk road, at Cleveland, Ohio, was destroyed by fire. Will be rebuilt.

The Toledo Screen Company, of Toledo, O., manufacturer of wire screening, is to erect an addition to its factory.

The Columbus (Ohio) Pump Supply Company has increased its capital and will want some new machine tools.

Ground will be broken in the spring for a new machine shop at the Bagley & Sewell plant in Watertown, N. Y.

E. C. T. Miller, 3738 Euclid avenue, Cleveland, Ohio, has been issued a permit for a large garage to cost $10,000.

The Youngstown Sheet and Tube Company, of East Youngstown, Ohio, is to build some large additions to its plant.

The White Automobile Company, Cleveland, Ohio, will equip a factory to make aëroplanes in addition to its auto factory.

The Briggs Manufacturing Company, of Detroit, Mich., body finishers and tinners of auto parts, is erecting a new factory.

A modern, three-story garage will be built at Seventh and Main streets, Cincinnati, O., by the Citizens Motor Car Company.

The Bessolo Wrench Manufacturing Company, Spring Valley, Ill., will erect a plant. Complete equipment will be needed.

The Bucyrus Company, of Milwaukee, Wis., manufacturer of steam dredges, cranes, etc., is building new shops at Evansville, Ind.

The Park Drop Forge Company, Cleveland, Ohio, makers of auto forgings, will build and equip a large addition to its present plant.

The Cream City Can Works, Milwaukee, Wis., will build a two-story addition to its plant on South Water street, near Ferry.

The Fischer Auto and Service Company, Cincinnati, Ohio, recently organized, will equip a garage. A. G. Fischer is manager.

The W. W. Sly Manufacturing Company, Cleveland, Ohio, maker of foundry supplies, will add some new machine tools to its factory.

The Strong Manufacturing Company, of Bellaire, Ohio, manufacturing enameled ware, will move to Sebring, where a new plant will be erected.

The Sterling Brass Company, just incorporated at Cleveland, Ohio, for $35,000, will want brassworking machinery. A. A. Benesch and others.

Baldwin Locomotive Works is having plans made for a one-story shop building to be used as addition to its machine shop at Eddystone, Penn.

The Knickerbocker Ice Company, at 3014-16 East Eighty-second street, Chicago, Ill., will build a one-story building to be used as a repair shop.

The Cream City Foundry Company, Milwaukee, Wis., is planning the erection of an addition to its plant at Fifteenth and Oklahoma avenue.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 5, for six rivet forges as per Schedule 4064.

The Briggs Detroiter Company, of Detroit, Mich., has been incorporated to manufacture automobiles. Will build a touring car called the "Detroiter."

The General Time Recorder Company, Cleveland, Ohio, has raised its capital to $150,000, and will need some new machinery for its factory.

The Illinois Malleable Iron Company, 2925-37 North Paulina street, Chicago, Ill., will build a one-story building for a foundry to increase capacity.

C. G. Coon, Inc., Elkart, Ind., has been incorporated with a capital of $250,000 by C. G. Conn, W. F. Seidel and J. F. Boyer, to manufacture musical instruments.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., December 30, for spillway gate, machines and pumps as per circular No. 661.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., November 22, for locomotive cranes, stiff-leg derricks, hoisting engines as per circular No. 662.

Chicago (Ill.) Railway and Mill Supply Company has been incorporated with $5000 capital to make railway machinery and equipment, by A. W. Gillespie, C. B. Royal, J. S. Zeley.

The Columbus Fence Company, of Columbus, Ohio, has been incorporated to manufacture a patented steel fence and will need equipment. H. T. Fisher, principal stockholder.

Ground has been broken for a new factory for J. W. Wells and M. B. Lloyd, at Phillips avenue and State street, Menominee, Mich., for the manufacture of wire-weaving machinery.

The Hartmann, Hay & Reis Company, Belleville, Ill., has been incorporated to manufacture nails, etc. Capital, $60,000. Incorporators, Bernhard Hartman, Jas. M. May, E. Reis, etc.

The Joliet Forge Company, Joliet, Ill., has been organized to manufacture iron and steel forgings. Capital, $30,000. Incorporators, John J. Sharpe, H. William Sharpe, Edward F. Sharpe.

The Bradley-Phillips Company, East Orange, N. J., has been organized to manufacture

sheet-metal products. Capital, $25,000. Incorporators, Chas. Bradley, John Phillips, H. M. Bradley.

The Schantz Company, New York, has been incorporated to manufacture ice machinery. Capital, $50,000. Incorporators, K. Wegemann, W. S. Shipley, New York; K. W. Schantz, Buffalo.

United States Steel Tank and Pipe Company, Chicago, Ill., has been organized to make ventilating and power-saving system, by Harry N. Miller, S. M. Schall, A. C. Meyer. Capital, $10,000.

The Sterling Brass Company, of Cleveland, Ohio, has been incorporated to manufacture brass goods and will need equipment of various kinds. H. A. Rocker, A. J. Koonhauser, principal stockholders.

Hartmann, Hay & Reis Company, Belleville, Ill., has been incorporated to manufacture nails and other steel products by Bernhard Hartmann, Jas. M. Hay, Ernest E. Wanglin, etc. Capital, $60,000.

The Newberry Sales Company, Chicago, Ill., has been organized with $45,000 capital to manufacture electric and other machines, etc. Incorporators, Edward J. McCarty, Abraham Bartelstein, Nathan Jacobs.

Joliet Forge Company, Joliet, Ill., has been incorporated with $10,000 capital to manufacture and deal in iron and steel forgings, machinery, etc., by John J. Sharpe, H. William and Edward F. Sharp.

The General Auto and Repair Company, Chicago, Ill., has been organized with $25,000 capital to conduct a general garage and automobile business. Incorporators, W. R. Potter, Geo. H. Davis, Jr., etc.

The Quinn Manufacturing Company, of Kalamazoo, Mich., manufacturer of plumbers' supplies, is to move its plant to Detroit, Mich., where it will occupy a new factory which is being erected there.

The Bernston Spring Wheel Company, of Washington, D. C., has purchased site on Broad avenue, near Collins, Pittsburg, Penn., and will erect a plant for the manufacture of wheels for autos and auto trucks.

The National Brass Foundry Company, Chicago, Ill., has been incorporated to manufacture babbitt metals, metal castings, etc. Capital, $20,000. Incorporators, John Prince, Harry G. Dekker, Geo. McGuire.

Concrete Mixing and Conveying Company, Chicago, Ill., has been organized with a capital of $100,000 to manufacture concrete building machinery, etc., by Geo. Gillette, R. F. Elwell and Russell P. Fischer.

The Gordon Electric and Manufacturing Company, Chicago, Ill., has been incorporated to manufacture electrical devices and apparatus. Capital, $15,000. Incorporators, Hazel Jones, Otto M. Werich, Max W. Zabel.

The Penn Motor Car Company, manufacturer of automobiles, formerly located at Wilkinsburg, a suburb of Pittsburg, has acquired ten acres of land at New Castle, Penn., and will erect a plant of several buildings.

The Chevrolet Motor Company, of Detroit, Mich., has been incorporated to manufacture automobile engines and will start operations as soon as equipment can be obtained. Louis Chevrolet, E. R. Campbell, principal stockholders.

The Detroit Bi-Car Company, of Detroit, Mich., has been organized to manufacture a new design of motor cycle and is starting operations in a temporary factory. It will need necessary equipment. J. J. Chapin, president.

The Marshall Machinery and Supply Company, Phillipsburg, N. J., has been incorporated to manufacture machinery, shelf hardware, etc. Capital, $25,000. Incorporators, Frank J. Marshall, Easton, Penn.; Chas. S. Firth, O. D. McConnell, Phillipsburg, N. J.

J. N. Willys, of the Willys-Overland Company, of Toledo, Ohio, has become one of the directors of the Palmer-Moore Company, of Syracuse, N. Y., which has increased its capital and will erect a new and larger plant for the manufacture of engines to be used in the Overland autos and auto trucks.

SOUTHERN STATES

The White Adding Machine Company, Nashville, Tenn., recently organized with $400,000 capital, has secured site for a plant in South Nashville.

WEST OF THE MISSISSIPPI

Boliin & Matthew, Reedley, Cal., will erect a tin and metal-working shop.

W. L. Todd, Tacoma, Wash., plans for the erection of a commercial garage and repair plant.

The plant of the Vineyard blacksmith shop, Lakeview, Ore., was destroyed by fire. The plant will be rebuilt.

The Reliance Foundry Company, 1168 Harrison street, San Francisco, Cal., is contemplating the installation of molding machines.

W. H. Chambers, Lancaster, Wash., plans for the erection of a blacksmith shop. The plant will be fully equipped to handle repair work.

The Boulevard Garage, First street, San Francisco, Cal., will build a new commercial garage and repair plant. Modern machinery will be installed.

The Southern Oregon Automobile Company, Klamath Falls, Ore., will build a commercial garage and repair plant. Modern machinery will be installed.

Rockwood & Richards, Salt Lake City, Utah, have taken out a permit to build a new blacksmith shop on East Sugar avenue. Modern equipment will be installed.

The Atchison, Topeka & Santa Fé Railway Company is contemplating the expenditure of $2,000,000 for terminal facilities and new shops at Sweetwater, Texas.

The Cyclops Iron Works (Victor Etienne, Jr.), San Francisco, Cal., has taken out a permit to build an addition to its machine shop and to erect a new pattern shop building.

J. L. Mellis, Los Angeles, Cal., has leased property on South Grand avenue, and will establish a commercial garage and repair plant. Modern machinery will be installed.

J. K. Keena, Seattle, Wash., agent for the Packard Automobile Company, is having plans prepared for a new commercial garage and repair plant to be erected on Twelfth street.

W. W. Culver & Son are erecting a modern hotel on the corner of Fourteenth and Chestnut streets, St. Louis, Mo., to cost $200,000. Will install refrigerating and heating plant.

John Wright, Hollywood, Los Angeles, Cal., is having plans prepared for a commercial garage and repair plant to be erected at Beverly Hills. Modern equipment will be installed.

The Olympia Ice Machine Company, Tacoma, Wash., will build an addition to its ice-machine manufacturing plant. About $15,000 will be expended. New equipment will be installed.

The Matheson Sales Agency, Oakland, Cal., has had plans prepared for a commercial garage and machine shop to be erected on East Twelfth street. Modern machinery will be installed.

The Patent Broom Machinery Company, Phœnix, Ariz., has been incorporated to manufacture machinery for making brooms. Geo. W. Duval is president, and C. R. Lee, vice-president.

J. B. Newman, Santa Monica, Cal., is having plans prepared for a commercial garage and repair shop. Modern equipment will be installed. H. H. Miller is also interested in this work.

The Regan's Oil Well Tool Works, Sherman Junction, near Los Angeles, Cal., is having plans prepared for a new machine shop and blacksmith shop. Modern equipment will be installed.

The city of Alameda, Cal., is having plans prepared for manual training addition to its high school. Modern equipment will be purchased for the building. The school board is in charge.

The Glenwood Garage (Dundas & Gamble), Riverside, Cal., contemplates the erection of a large commercial garage and repair plant on West Seventh street. The plant will be fully equipped.

The Alvey Brothers Machinery Company, St. Louis, Mo., has been organized to manufacture machinery. Capital, $12,000. Incorporators, John A., Phillip C., Wm. F. and Hugh H. Alvey.

The Big Bend Garage, Davenport, Wash., has been acquired by E. A. Johnson and Peter Selde. The new owners will establish a new commercial garage and repair shop and will install modern equipment.

The Kelman Electric and Manufacturing Company, Los Angeles, Cal., manufacturer of oil switches and electrical machinery, will build a new plant on Naud street. A permit for the building has been issued.

The Meyer Waterlift and Power Company, Grand Junction, Colo., plans for the erection of a plant at Edmonds, Wash., for the manufacture of a patented centrifugal pump. I. A. Moon is secretary of this organization.

The Northern Pacific Railway Company has awarded a contract for the erection of its shop buildings at Pasco, Wash. The plant will include a 37-stall roundhouse, car shops, sand house, boiler plant and other buildings.

The Deft Adding Machine Company, Kansas City, Mo., has been incorporated with $50,000 capital and will equip a plant for the manufacture of adding machines. W. C. Renfrew, L. A. Robertson, H. B. Renfrew, are incorporators.

The New Hampton (Iowa) Manufacturing Company will move to Sioux City, Iowa, and operate under the name of the Stickley-Hunter Gas Engine Company. The firm manufactures stationary gas engines and later may build tractors.

J. S. Atterbury, Los Angeles, Cal., is having plans prepared for a plant on Grand avenue for the manufacture of windshields. A commercial garage and machine shop will be established in connection. Modern equipment will be installed.

The Walton Furnace Company, Salt Lake City, Utah, has been incorporated by W. W. Evans, T. A. Mulholland and J. T. Brown, with a capital stock of $500,000. The company plans for the erection of a plant for the manufacture of furnaces near Salt Lake City.

In connection with its new manufacturing plant at Long Beach, Cal., the California Glass Insulator Company, Los Angeles, will erect a modern garage for the care and repair of its commercial automobiles. The plant will be fully equipped. Robert F. Frift is manager.

The Oakland (Cal.) Elevator Company has been incorporated by W. J. Wigmore and A. R. Hansen, with a capital of $100,000. The company will purchase a site at Oakland, and will erect a plant for the manufacture of passenger and freight elevators and hoisting machinery.

The Vulcan Industrial Engineering Works, Seattle, Wash., has been incorporated with a capital of $1,500,000 to construct machinery, cars, boats and kindred products. Wm. A.

MacDonald, D. M. Walters and W. H. Philips are directors. Headquarters will be established at Seattle.

The Board of Education, Huntington park, near Los Angeles, Cal., will build a manual training addition to the Union high school. The building will contain forge shop, pattern shop, foundry, machine shop and drafting room, and will be fully equipped. Robert M. Taylor, architect, Los Angeles, has prepared plans.

CANADA

The Grand Trunk Pacific will equip new repair shops at Melville, Sask.

The Canadian Steel Foundries, of Montreal, is making big extensions to its plant.

The Legett & Platt Spring Bed Company will locate a new factory at Windsor, Ont.

The Copp Stove Company, of Fort William, Ont., will build a big extension to its factory.

The Moffat Stove Company, of Weston, Ont., will build a big addition to its foundry.

The Orillia Garage Company will equip a large new garage and repair shops at Orillia, Ont.

The John Morrow Machine Screw Company, of Ingersoll, will build a big addition to its factory.

The Positive Clutch and Pulley Company, of Buffalo, will build an addition to its factory at Aurora, Ont.

The Dominion Iron and Steel Company, of Sydney, N. S., will buy machinery for developing 20 new collieries.

The Agutter Griswald Company will locate a new plant at Vancouver, B. C., to manufacture electrical apparatus.

FOREIGN

John Tragardh & Co., Gothenburg, Sweden, are inquiring for machinery for corrugating iron sheets.

General Manufacturing

NEW ENGLAND

Egremont, Mass., contemplates the installation of a new water system.

The United States Shuttle Company, Lowell, Mass., is to erect a new factory.

The picker house of the Davisville (R. I.) Woolen Company was destroyed by fire.

Hardwick, Vt., has issued $25,000 bonds for improvements to its electric-lighting system.

Pittsfield, Mass., will issue $100,000 bonds for improvements to its waterworks system.

M. J. Whittall will erect a cold-storage building on Brussels street, Worcester, Mass.

The sawmill and planing mill of D. A. Witler, of Otis, Mass., was destroyed by fire.

The sawmill and finishing mill of Jos. Dagnais, Fairhaven, Vt., destroyed by fire. Loss, $12,000.

Cleophas and Malvina Couture will erect a carriage shop at 38 Portland street, Worcester, Mass.

The city of Boston (Mass.) contemplates erecting a central power station on Deer island to cost $181,000.

The National Wadding Manufacturing Company, of Marlboro, Mass., is contemplating the installation of a new boiler.

The Plainville Water Company, Plainville, Conn., has let the contract for the construction of a new pumping plant.

The Golding Manufacturing Company, of Franklin, Mass., is contemplating getting a new engine in the near future.

A three-story mill, at Burlington, Vt., owned by American Woolen Company, was destroyed by fire. Loss, $30,000.

The Belmont laundry has taken out a permit to build an addition to its plant at 331-333 Belmont avenue, Springfield, Mass.

The Bristol & Warren Waterworks, Bristol, R. I., will expend $100,000 for improvements and the extension of its waterworks system.

The plant, including machinery, of the Homestead Company, a Springfield (Mass.) newspaper concern, was badly damaged by fire and water. Loss, $7000.

The Biddeford (Me.) Box Company has been incorporated with $50,000 to do woodworking and manufacture wooden articles and holders. Edward V. Varney, of Fall River, Mass., is president.

Fire caused several thousand dollars damage to the brick-manufacturing plant of the Stiles & Reynolds Company, Berlin, Conn. The engine house, a dynamo and a quantity of machinery was destroyed.

Robert Whittaker Company, Northboro, Mass., has incorporated with $50,000 capital to manufacture cotton and wool shoddies, and to do carding, picking and carbonizing. The Chapin mill property, of Northboro, will be equipped immediately for this purpose. James Whittaker, Fall River, Mass., president; Robert Whittaker, Newton, Mass., treasurer.

MIDDLE STATES

The Pittsburg (Penn.) Armature Company will erect a new factory.

Le Roy, N. Y., will issue $44,000 bonds for improvements to its water system.

The G. M. Adams canning factory, of Leland, Mich., was destroyed by fire.

Albany, N. Y., will issue $100,000 bonds for improvements to its water system.

Contract has been let for a new factory for the Detroit (Mich.) Excelsior Company.

Madison, Wis., will issue $20,000 bonds for improvements to its waterworks system.

The Hart Ice Cream Company, Columbus, Ohio, will want some power machinery.

J. F. Dunn and E. Dresher contemplate erecting a grain elevator at Milliston, Wis.

Work has been started on a new municipal waterworks system at New Lexington, Ohio.

Hubbard, Ohio, will issue $30,000 bonds for improvements to its waterworks system.

The large grain elevator of Stewart & Geidel, Pittsburg, Penn., was destroyed by fire.

The hosiery mill of W. Wolfinger, of Reading, Penn., was destroyed by fire. Will rebuild.

Borden's Condensed Milk Company is considering the establishment of a plant at Salem, N. Y.

The Chicago (Ill.) Telephone Company will build a one-story telephone exchange at 3322 Sheffield avenue.

The Edison Illuminating Company, of Detroit, Mich., will erect another substation and will need equipment.

The Willys-Overland Company will install a large boiler at its Indianapolis, Ind., plant, Drover and Oliver avenue.

The Roberts Powder Mill, at Kreb's station, near Shenandoah, Penn., was destroyed by fire and explosion. Loss, $7000.

The Crescent Milk Bottle Company, Mt. Vernon, Ohio, will want glass-bottle machinery. C. M. Tigner, manager.

The plant of the J. Street Milling Company, Laporte, Ind., flour millers, was destroyed by fire. Will be rebuilt at once.

The Glen Willow Ice Company has let contract for an addition to its ice-manufacturing plant at Manayunk, Penn.

The Chicago (Ill.) Oyster Pail Company is preparing plans for the erection of a four-story factory to cost $125,000.

The Coöperative Elevator Company, Liberty Center, Ohio, will erect a large grist mill. J. A. Wright, manager.

The town council, of Cambridge City, Ind., has contracted for the erection of a building for a new electric-light plant.

The Second National Bank of Toledo, Ohio, will erect a 20-story office building there. Power equipment will be needed.

The Nungesser Carbon and Battery Manufacturing Company, Cleveland, Ohio, will make additions to its power plant.

The Fisher Body Company, of Detroit, Mich., maker of wood and metal automobile bodies, is erecting a new factory.

Matthew Brothers Manufacturing Company, Milwaukee, Wis., will build an addition to its furniture plant at 61 Fourth street.

The paper-box factory of Spangler & Co., of 1245 North Howard street, Philadelphia, was destroyed by fire. Loss, $15,000.

The Canton Porclain Company, Canton, O., incorporated to equip a plant to make porcelain goods. F. A. Fenton and others.

Wilbur & Son, manufacturers of chocolates, have let contract for a seven-story addition at 234 to 238 New street, Philadelphia.

The Ludowici-Celadon Company, New Lexington, Ohio, manufacturer of roofing tile, will build large additions to its plant.

The Mutual Boxboard Company, Utica, N. Y., is building an addition to its plant to increase its capacity about 25 per cent.

A. Pfaumer has let contract for a one-story cold-storage warehouse at Fifty-seventh and Market streets, Philadelphia, Penn.

The Robinson & Albright Company, of Marysville, Ohio, is having plans prepared for the erection of a new packing plant.

The Champion Spark Plug Company, Toledo, Ohio, has commenced the erection of a new plant at Upton and Avondale avenues.

Chas. Garben Baking Company, 237 East Ontario street, Chicago, Ill., will build a one-story addition and install new machinery.

The Diagonal Block Tire Company, of Akron, Ohio, has been incorporated to manufacture automobile tires by J. A. Swinehart.

Fire destroyed half of factory No. 4 of the American Window Glass Company, at Belle Vernon, Penn., entailing a loss of $60,000.

The United States Metal Polish Company, Indianapolis, Ind., will erect a factory at Belt railroad and Quill street to cost $20,000.

The coffee-roasting plant of Robert Smith & Son, of 1215 to 1219 South Third street, Philadelphia, was destroyed by fire. Loss, $20,000.

The A. Haberman Company, of Cleveland, Ohio, will erect a new engine house and make additions to its power-plant equipment.

The Goodsell Manufacturing Company, of Toledo, Ohio, maker of doors, sash and blinds, will erect an addition to its factory.

The Berkey & Gay Furniture Company, of Grand Rapids, Mich., has doubled its capital and will make extensive improvements to its plant.

The Merchants National Bank, of Indianapolis, Ind., will erect a 16-story building to

cost $1,000,000. Power plant will be installed.

The D. C. Jenkins Glass Company, of Kokomo, Ind., has purchased property at Whiting, Ind., and is preparing plans for a new factory.

The Lundstrom Manufacturing Company, Little Falls, N. Y., manufacturing office furniture, is planning the erection of a five-story addition.

The Rockwell Manufacturing Company, Milwaukee, Wis., manufacturing sash, doors, blinds, etc., is contemplating an addition to its plant.

A building permit has been issued for a boiler house at Walnut lane and Freeland avenue, Philadelphia, Penn., for A. & J. Flanagan.

Damage amounting to about $100,000 was done by fire at the plant of H. Krantz & Co., manufacturers of electrical supplies, Brooklyn, N. Y.

Work will be started at once on a four-story addition to the plant of the J. P. Baltz Brewing Company, Philadelphia, Penn., to cost $9000.

Otley Manufacturing Company will build a one-story factory at 1742 North Winchester avenue, Chicago, Ill., and equip same for a paint plant.

The Universal Fiber Board Company, Rochester, N. Y., recently incorporated with $200,000 capital, may locate a plant in Middletown, N. Y.

W. F. Hayes, of 35 South Sixth avenue, Mount Vernon, N. Y., will move his silversmith factory into a larger building in South Third avenue.

The R. Fehler Brush Company, 395 Reed street, Milwaukee, Wis., is having plans drawn for an addition and remodeling present building.

O. L. Miller & Co., Indianapolis, Ind., manufacturers of cement building blocks, will erect a factory building at 407 West Seventeenth street.

It is reported that the United States Steel Corporation is considering the erection of a pyrites refining mill at Pyrites, St. Lawrence county, N. Y.

The Vincennes (Ind.) & Southeastern Railroad Company will build an electric railroad from Vincennes to Tell City, Ind. Work will begin shortly.

The city of Akron, Ohio, is conducting negotiations for the purchase of the waterworks system and upon its purchase will enlarge and improve same.

The plant of the American Wood Grain Company, of Detroit, Mich., manufacturer of wood finishes, was destroyed by fire. Will be rebuilt at once.

Damage approximating $50,000 was caused by explosions and fire in the Du Pont Powder Works, at Haskells, N. J. Valuable machinery was burned.

Trion Horn Manufacturing Company, Conneaut, Ohio, has been incorporated to make automobile horns. Will equip a factory. I. E. Stump, manager.

St. John's Hospital, Cleveland, Ohio, will want some power and other mechanical equipment for a new $100,000 building. W. S. Lougee, architect.

The Standard Top and Equipment Company, Cleveland, Ohio, makers of auto tops and supplies, will make some additions to its factory equipment.

The Chippewa River Power Company has purchased the plant of the Harris Electric Company, of Mt. Pleasant, Mich., and will add new equipment.

Harvey Brothers, of Cleveland, Ohio, will greatly increase the capacity of its power plant if a franchise, which is pending in council, is granted them.

The Redlick Manufacturing Company will build a three-story factory at 637-647 West Oak street, Chicago, Ill., will equip it to manufacture cork articles.

The Ziggler Colliery Company, Christopher, Ill., will install complete electrical equipment, including four 700-kilowatt turbines. Alex. Watts, superintendent.

H. M. Byllesby & Co., Chicago, Ill., will expend $5,000,000 for the construction of a large electric power plant at Cumberland Falls, near Louisville, Ky.

A permit has been issued for the construction of a two-story factory for the American Rubber Company, at 406 East Rittenhouse street, Philadelphia, Penn.

The Sheridan Water, Light and Heat Company, Sheridan, Ind., has been incorporated with a capital of $100,000 by J. L. Vickery, Perely Weaver and others.

Fire destroyed the pie-plate and butter-tray plant of the Duncan-Woolworth Company at Bridge and Mill streets, Albany, N. Y. Loss, about $23,000.

The plant of the National Pickle and Canning Company, at Knox, Ind., which was totally destroyed by fire recently will be rebuilt early in the new year.

The Martin Adjustable Piano Bench Company, of Cleveland, Ohio, has been incorporated to manufacture piano benches by C. H. Martin, F. M. Farnsworth, etc.

The Webb Terminal Warehouse Company, of Philadelphia, has let contract for a cold-storage plant at Water and Walnut streets, Philadelphia, to cost $100,000.

The Brillion (Wis.) Manufacturing Company, whose plant recently burned, is preparing to rebuild. The concern manufactures cheese boxes and canners' supplies.

The Francke Lumber Company will increase the capacity of its mills at St. Bernard, O., having recently acquired a large tract of ground adjoining the present plant.

Machinery will be required for the new power-plant addition of the Pt. Pleasant Water and Light Company, Pt. Pleasant, W. Va. Bert Baldwin & Co., Cincinnati, engineers.

Workmen have begun extensive additions to the plant of the Orinoco Furniture Company (builders of mahogany and walnut furniture exclusively), at Columbus, Ind.

A boiler explosion in the plant of the Mt. Clemens Sugar Company, of Mt. Clemens, Mich., partially destroyed the plant. Will be rebuilt and equipment replaced at once.

Brookport Pearl Button Company, Brookport, Ill., has been incorporated with $20,000 capital to manufacture pearl buttons, etc., by J. M. Mitchell, M. J. White, L. E. Mitchell.

The Sheridan Ice and Fuel Company, Sheridan, Ind., has been incorporated with a capital of $15,000 by J. A. Branson and others. Will manufacture and deal in ice, etc.

The Magic City Laundry Company, of Barberton, Ohio, has been incorporated to do a general laundry business and will need equipment. T. M. Fisher, principal stockholder.

The University of Michigan, at Ann Arbor, Mich., is calling for bids for the erection of a power house and additions to its water-supply system. Shirley W. Smith, secretary.

The Victor Broom Company, of Grand Rapids, Mich., will move its plant to Detroit, Mich., where it will make numerous extensions to take care of its increasing business.

The American Paper Box Company, of Cleveland, Ohio, has been incorporated to manufacture paper boxes and will purchase equipment. M. Lazworth, principal stockholder.

The Terre Haute Creamery Company, of Youngstown, Ind., has been incorporated to do a general creamery business. Will need equipment. Avery Boyll, Orien Smith, principal stockholder.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids November 28, for four portable geared pneumatic hoists for the Norfolk navy yard, as per Schedule No. 4069.

Edward B. Reed, representing the Clearfield Brick Company, of Clearfield, Penn., has been in North Tonawanda, N. Y., negotiating for a site for a plant which the company considers erecting there to manufacture bricks.

D. Auerbach & Sons, candy manufacturers, 334 West Thirty-ninth street, New York, will erect a new factory to occupy the entire block on Eleventh avenue, between Forty-sixth and Forty-seventh streets, which will cost $750,000.

Architect O. N. Chamberlain, Cleveland, O., has prepared plans for a number of moving-picture theaters for the Alexander Amusement Company. Each theater is to be equipped completely with electric-light and steam-heating plants.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 5, for 25,000 pounds of commercial bar steel, 12,650 pounds sheet brass, 40,000 pounds ingot copper, 39,000 pounds billet steel (schedule 4065).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids November 28, for two tool-hardening and annealing furnaces (Schedule No. 4070), 79 steam gages, generators and spare parts, lubricating grease (schedule 4078).

The United States Government has appropriated $20,000 for the construction of a plant in conjunction with the arsenal at Picatinny, N. J., for the manufacture of high explosives used in naval shells. The Navy Department at Washington, D. C., has charge.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 5, for steel bolts and nuts (schedule 4065), twist drills, steel rivets, brass machine and wood screws, steel squares, taps and dies, crew wrenches (schedule 4064).

E. J. Page, of Syracuse, and Coleman W. Brownson, of Hicksville, N. Y., are among the directors of the Southern Paper Company, which has been incorporated in Onondaga county, capitalized at $1,000,000, to make Swedish Kraft paper. A large pulp mill and paper mill will be erected.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 12, for furnishing and installing electric traveling crane in the Mare Island, Cal., navy yard (schedule 4071), and for two portable oil-burning furnaces for the Puget Sound, Wash., navy yard (schedule 4073).

Dr. F. S. Pearson, 25 Broad street, New York City, is at the head of the Barcelona Company, recently incorporated with head offices at Toronto, Can., for developing water power aggregating 250,000 horsepower and constructing hydroelectric power plants to supply light and power to the northeastern section of Spain.

The Green Bay Traction Company, the Green Bay Gas and Electric Company, and the Northern Hydro Electric Company, of Green Bay, Wis., have been sold to Clement C. Smith and other Milwaukee capitalists, and will be consolidated under the name of the Wisconsin Public Service Company. Many improvements, additions and extensions are planned.

SOUTHERN STATES

The Harlan & Lowe Milling Company will build a new elevator at Bardwell, Ky.

New machinery will be installed by Jacob Boblitz, Woodstock, Md., who has just purchased 100 acres of land and will open a feldspar quarry.

Ellensburg, Va., will issue $100,000 bonds for improvements to its waterworks system; also $110,000 bonds for its electric-lighting and power system.

The city of Enfield, N. C., will receive bids up to December 8, for the construction of an electric-light plant. C. E. Fairbanks, American National Bank building, Richmond, Va., engineer.

WEST OF THE MISSISSIPPI

Mr. Hart, Hart Station, Lost Hills, Cal., plans for the erection of an ice plant.

Rapid City, S. D., will issue $60,000 bonds for improvements to its water system.

The Finnel Tract Land Company, Corning, Cal., will install a new pumping plant.

The Carbo Petroleum Company, Taft, Cal., will install new electric motor equipment.

Henry, S. D., will issue $10,000 bonds for improvements to its waterworks system.

Sioux Falls, S. D., will issue $100,000 bonds for improvements to its waterworks system.

Hill City, Minn., will issue $15,000 bonds for improvements to its waterworks system.

The Sherwood (Ore.) Commercial Club plans for the erection of a fruit-canning plant.

L. C. Reynolds, North Bend, Wash., will build a new sawmill plant on the Siuslaw river.

The Coquille (Ore.) Lumber Company will install new machinery at its lumber-working plant.

The People's Packing and Ice Plant Company, Eugene, Ore., plans for the erection of a new ice plant.

The city of Hillsboro, Ore., has voted bonds for $70,000 for the installation of a modern sewerage system.

The manufacturing plant of the Butte (Mont.) Sewer Pipe and Tile Company was partially destroyed by fire.

Harlingen, Texas, will issue $31,500 bonds, part of which will be for improvements to its water and lighting systems.

The city of Hood River, Ore., has voted bonds for $90,000 for the installation of a modern waterworks system.

Fire completely destroyed the large two-story laundry building of the New York Sanatarium, at Otisville, N. Y.

E. S. Ayres, Los Angeles, Cal., plans for the installation of an electric-lighting system at Tropico, near Los Angeles.

The city of Granger, Wash., will install a modern waterworks system. City Engineer N. W. Avery is preparing plans.

The Haines Tanning Company, Everett, Wash., will build an addition to its tannery plant. The capacity will be doubled.

Hodgkins & Godsave, Ontario, Cal., have taken out a permit to build a new planing mill. Modern woodworking machinery will be installed.

The Ensalada Oil Company, Patterson, Cal., recently incorporated, plans to install oil-drilling machinery on its property west of Patterson.

C. A. Doty, Seattle, Wash., has acquired the J. E. Page Lumber Company's mill, at Kelso, Wash. Improvements will be made in the plant.

The Coquille (Ore.) Valley Creamery Company is planning the erection of a modern creamery plant at Marshfield, Ore. The plant will be fully equipped.

The salmon-canning plant of Gorman & Co., Seattle, Wash., at Prince of Wales Island, Alaska, was totally destroyed by fire. Loss, estimated at $100,000.

The Lakeview (Ore.) & Pine Creek Telephone Company plans for the corstruction of a telephone system in the Goose Lake valley district. E. C. Thurston is president.

The Elk Grove (Cal.) Winery will increase the capacity of its wine- and brandy-manufacturing plant. New machinery will be installed. The Da Roza estate owns this property.

The Bernice Water Company, Brawley, Cal., plans the erection of a large electric power plant on the Alamo river. W. H. Best and Frank Salisbury are at the head of this company.

The Pacific Telephone and Telegraph Company, Los Angeles, Cal., will make improvements and additions in its exchange plant at Pasadena, Cal. New equipment will be installed.

The Alhambra (Cal.) Orange Growers' Association has taken out a permit to build a new fruit-packing plant to replace that recently destroyed by fire. Modern machinery will be installed.

The California-Coalinga Oil Company, Coalinga, Cal., plans to install new oil-drilling machinery on recently acquired property in this section. About $150,000 will be expended in oil-drilling operation.

The Pacific Sewer Pipe Company, Los Angeles, Cal., plans for the erection of a new plant for the manufacture of sewer pipe and cement pipe for irrigation work. About $350,000 will be expended.

Power-plant equipment will be installed in the new 12-story office building to be erected by the *Oregon Journal* (C. S. Jackson), Portland, Ore. Reid Brothers, architects, San Francisco, Cal., are preparing plans.

The printing plant of the Dillingham Printing Company, Bairdstown, near Los Angeles, Cal., was destroyed by fire with a loss of $30,000. The plant will be rebuilt. W. C. Dillingham is head of this company.

The Newport Beach (Cal.) Electric Light and Power Company (C. H. L. Ghriest, proprietor) plans for the erection of an electric power plant at Beaumont, Cal. In connection, an ice plant and steam laundry will be established.

The Wheeler Ridge Oil Company, Bakersfield, Cal., recently organized, has acquired property near Bakersfield, and plans to install machinery for oil drilling. George M. West and P. L. Lindley, both of Los Angeles, Cal., are interested in this company.

Power-plant equipment, steam-laundry machinery and a cold-storage plant will be installed in the new hotel to be erected by Mrs. R. B. Young, on West Seventh street, Los Angeles, Cal. R. B. Young & Sons, architects, Los Angeles, are preparing plans.

The Washington Water Power Company, Spokane, Wash., plans for the erection of a large hydroelectric power plant at Long Lake, with a total generating capacity of 90,000 horsepower. The work is estimated to cost $4,000,000. D. L. Huntington is president.

The Sierra Electric Power Company, Oakland, Cal., has been incorporated by Charles Gross, E. A. Herman and J. E. Bowes, all of Oakland, with a capital of $3,000,000. The company plans for extensive operations in the lighting and power business in this vicinity.

M. J. Lee, manager of the Canby (Ore.) Canal Company, is at the head of a company which plans for the erection of an electric power plant on the Molalla river, in connection with a large electric railway system to be constructed from Canby to Portland, and adjacent points.

The Alton & Southern railway has incorporated with a capital of $10,000,000 to construct and operate a railroad from St. Louis to East St. Louis, Mo. Incorporators are Arthur V. Davis and R. B. Mellon, of Pittsburg, Penn.; C. B. Fox and Charles Sonder, of East St. Louis and others.

The National Ice and Cold Storage Company, San Francisco, Cal., has been incorporated with a capital of $6,000,000 by A. F. Morrison, W. H. Smith, Jr., and Edwin Schwab, all of San Francisco, and A. L. Whittle, Mill Valley, Cal. Headquarters will be maintained at San Francisco.

The Pacific Gas and Electric Company, San Francisco, Cal., plans for the erection of two electric power plants on the South Yuba river, with a total generating capacity of 50,000 horsepower. The company also plans for the erection of a gas-manufacturing plant at Pittsburg, Cal., to cost $100,000.

The Blevins-Maynard-Childs Company, Deming, N. M., has been incorporated with a capital of $50,000 to construct and operate electric power plants, pumping plants and simlar enterprises. E. A. Blevins, Silver City, N. M.; A. B. Maynard, Las Cruces, N. M., and A. H. Childs, El Paso, Tex., are incorporators.

The Pacific American Fisheries Company, Bellingham, Wash., plans for the erection of a new fish-canning plant at Ocean Dock, Bellingham. The company nas acquired a site on Prince of Wales island, Alaska, and will erect a large fish-canning plant. The company's cannery at King Cove, Alaska, will be removed to a point on Belkofsky bay, and the present capacity increased.

CANADA

Moose Jaw, Sask., will buy steam pumps.

Baden, Ont., will equip a new hydro power station.

New Westminster, B. C., will purchase rock-crushing machinery.

The American Safety Powder Company will locate a new plant in Vancouver.

The Interlake Tissue Paper Mills will equip a big new plant at Merritton, Ont.

The Imperial Oil Company will equip a power house at Fort William, Ont.

The Coteau Power Company will develop power at a plant at Shuswap Falls, B. C.

Frank Hook will locate a big factory for manufacturing clay products at Medicine Hat.

The Brick and Tile Company, of Cloverdale, B. C., will build a big extension to its plant.

Southampton, Ont., will equip a new waterworks plant and electrical pumping equipment will be purchased.

The Carlyle Dairy Company, of Calgary, will build a big addition to its plant and install the latest machinery.

The Port Credit Brick Company, of Toronto, will install a large quantity of modern machinery shortly.

R. C. Thomas, of Calgary, is building a big business block there and will buy engine, boiler and electric apparatus, etc.

The Bennewitz Manufacturing Company will equip a new plant at Stratford, Ont., for making music boxes, keyboards, etc.

The Crown Gypsum Company will build a big new plant at Lythmore, in Oneida township, and will install complete new machinery.

Hamilton, Ont., will shortly equip a new hydro distribution system and tenders will be called for large quantities of equipment.

The Canada Iron Corporation, of Montreal, will equip a big gas-producing plant at

Fort William, in connection with its works there.

The New York & Pennsylvania Pulp and Paper Company, of Johnsonburg, Penn., will build a big pulp and paper mill near Cobalt, Ontario.

The city of Vancouver will spend $6,000,000 on improvements to its harbor. Electrical and waterworks equipment will be required.

The Empire Limestone Company, of Humberston, Ont., will make big extensions to its plant and purchase drills and other machinery.

The Canadian Pacific railroad will build a new $1,500,000 hotel and stores building at Calgary, B. C. Steam and electric equipment will be purchased.

Frank B. Allen, of Toronto, has purchased the plant of the Washington Terra Cotta Brick Company, at Terra Cotta, D. C., and will completely remodel it.

FOREIGN

The pumping plant of the Chipas mine, near Arispe, Sonora, Mex., was totally destroyed by flood. The plant will be replaced with new machinery.

The Penn-Sonora Mining Company, Nogales, Sonora, Mex., plans for the erection of an electric power plant at Aguascalientes for operation of its properties. B. H. Howard is interested in this company.

MINING

The Worden mine, near Gold Road, Ariz., contemplates the erection of a milling plant.

The Mascotte mine, Prescott, Ariz., will build a new reduction plant. H. E. Olund is general manager.

The Sunset Mining and Smelting Company, Cerrillos, N. M., contemplates the erection of a concentrating plant.

The San Poil Consolidated Mining Company, Republic district, Wash., plans for the erection of a milling plant.

The Dona Dora Mining Company, Kent, N. M., will install a milling plant. George S. Courtney is general manager.

The Jack Waite Mining Company, Wallace, Ida., will build a new 450-ton milling plant. About $75,000 will be expended.

The Midget Bonanza Gold Mining Company, Cripple Creek, Colo., will build a new cyanide plant and concentrating mill.

The Meal Ticket mines, near Dyke, Nev., contemplates the erection of a milling plant. James R. Clark is head of this property.

The Golden Age mine, Jamestown, Colo., plans for the erection of a 40-ton milling plant. A. H. Martin operates this property.

The Saufer-Davis mine, near Meadows, Ida., plans for the erection of a milling plant. C. A. Saufer, Asotin, Wash., is head of this property.

The cyanide plant of the Martin Creek mine, near Paradise, Humboldt county, Nev., was destroyed by fire. It is said the plant will be rebuilt.

The Gladstone mine, near Gilsonville, Cal., plans to increase the capacity of its stamp mill. New machinery will be installed. C. M. Root is manager.

The Grasselli Chemical Company, Park City, Utah, will build a milling plant for the handling of silver tailings. About $10,000 will be expended.

The Rubelin mine, Last Chance, near Forest Hill, Cal., plans for the installation of a new stamp mill. C. T. Snedeker is interested in this property.

The Jefferson Gold and Silver Mining Company, Round Mountain, Nev., plans for the installation of new operating machinery. C. J. Canrohat is president.

The Mulby Point mine, Eldorado county, Cal., plans for the erection of a 20-stamp mill. Laurence Brown, San Francisco, Cal., is interested in this property.

The Kettle River mine, near Rockcut, Wash., contemplates the installation of new machinery at its mill to separate zinc ores. W. S. Bliss, Orient, Wash., is manager.

The Buckskin mine, near Yerington, Nev., contemplates the installation of new operating machinery, including compressors, drills and pumps. N. G. Douglas, Jr., is head of this property.

The Associated Mining Company, Tonopah, Nev., recently organized, plans for the erection of a 10-stamp mill, cyanide plant and smelting plant. John G. Kirchen is head of this company.

The San Felipe Mining Company, Realito, Sonora, Mex., will install a complete equipment of new operating machinery; a new steam plant and ice plant will be erected. J. L. Shepherd is general manager.

BUSINESS ITEM

The American Ship Windlass Company's plant, which has been located for over a half a century in Providence, R. I., is now being abandoned and all the business of the company is being removed to Philadelphia where the company already has a large plant. To accommodate the growing business a large foundry has recently been erected in Philadelphia.

TRADE CATALOGS

Harvey Hubbell, Inc., Bridgeport, Conn. Catalog No. 14. Electrical specialties. Lamp guards, fixtures, sockets, etc. Illustrated, 114 pages, 6x9 inches.

Tate, Jones & Co., Pittsburg, Penn. Catalog. Heating, forging and welding furnaces. Illustrated, 32 pages, 5½x12 inches.

The Jeffrey Manufacturing Company, Columbus, Ohio. Catalog No. 50. Power-transmission machinery. Illustrated, 142 pages, 6x9 inches.

National Carbon Company, Cleveland, Ohio. Booklet. Brush Testing. Illustrated, 22 pages, 3½x6 inches.

Ingersoll-Rand Company, 11 Broadway, New York. Form No. 3109. Class NF-1 steam-driven, single-stage, straight-line air compressors. Illustrated, 12 pages, 6x9 inches. Form No. 3210. Class NE-1 power driven single straight-line air compressors. Illustrated, 12 pages, 6x9 inches.

General Electric Company, Schenectady, N. Y. Bulletin No. 4860. Generators for electrolytic work. Illustrated, 10 pages, 8x10 inches. Bulletin No. 4889. Commutator grooving machines. Illustrated, 4 pages, 8x10 inches.

FORTHCOMING MEETINGS

American Society of Mechanical Engineers, annual meeting, December 5 to 8, New York City. Calvin W. Rice, secretary, Engineering Societies building.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers, Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, AMER. MACHINIST.

Wanted—Screw machine work; send blueprints or samples for quotations. Remington Mfg. Co., Fitchburg, Mass.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Well established concern would consider manufacturing a small patented machine on royalty. Box 1372, New Haven, Conn.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

I specialize soliciting patents for clients that understand and appreciate patent work of highest professional skill, at moderate rates. Box 570, AMERICAN MACHINIST.

Hungary—A Budapest firm of high standing offers opportunities for increase of trade to a few first class American tool houses; references exchanged. Reply Box 512, AM. MA.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

A valuable system of patented piston rings, for pumps, compressors, oil, gasolene and steam engines, maximum compression, long life, 40 per cent. saving in manufacture. Information obtainable by addressing Lewis R. Compton & Co., 50 Church St., New York City.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CALIFORNIA

Wanted—On the Pacific coast, first-class toolmakers for experimental work; special tools, dies, etc., for small work in the typewriter class. Box 522, AMER. MACHINIST.

CONNECTICUT

Wanted—Draftsman accustomed to light punch and die and fixture work; also automatic press feeding devices. Box 563, AM. M.

ILLINOIS

Wanted—By a manufacturing concern in Chicago, first-class experienced metal spinner; first-class opening for sober industrious man; to receive attention, set forth full particulars, giving references. Box 560, AMER. MACH.

INDIANA

Electrical instrument maker for experimental work; steady employment for right party. Remy Electric Co., Anderson, Ind.

MASSACHUSETTS

Wanted—Foreman for mechanical maintenance department of manufacturing concern; must be familiar with millwright work, erection and general repair work on piping systems, and must be a thorough machinist; only an active man capable of handling men wanted; in answer, state age, nationality, salary and full particulars about experience and former positions. P. O. Box 22, Brightwood, Mass.

MICHIGAN

Wanted—Foreman for medium sized finely equipped tool room, high-grade man thoroughly experienced on tools, dies, fixtures for electrical work, magnetos, etc., in a clean beautiful city where rent and living expenses are low; give details of experience, age and references. Box 543, AMERICAN MACHINIST.

MISSOURI

Wanted—Superintendent who can invest $2000 to $3000; five-year contract. Suite 616, Commerce building, Kansas City, Mo.

NEW JERSEY

First-class tool designer wanted in large electrical manufacturing concern. Box 580, AMERICAN MACHINIST.

Wanted — Superintendent with executive ability for a plant operating punch presses on a single line of light work; must be progressive and experienced in modern factory methods, also thoroughly familiar in details of die making and punch press operation; an unusual opportunity for the right man; give full particulars as to age, experience and salary desired. Box 553, AMERICAN MACHINIST.

NEW YORK

Wanted—Machinist on machine repairs, who is experienced in oxyacetylene welding. Otis Elevator Company, Yonkers, N. Y.

Wanted—Tool steel salesmen for all States to sell a leading brand of high-speed and carbon steels; write, giving particulars, age, salary expected, experience, territory covered, to Box 259, AMERICAN MACHINIST.

Wanted—Chief draftsman, acquainted with crane and hoist construction; one who can give positive evidence of ability, can secure permanent and satisfactory position. Address Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Good opening for a few first-class mechanics to make fine interchangeable sewing machine parts by the contract; must be men of inventive ability, good habits, capable of making jigs and fixtures and improving machinery. P. O. Box 365, Philmont, N. Y.

Lathe demonstrator to operate lathes in the shops of customers; must be of forceful character with much tact and a thoroughly good lathe hand; preferably unmarried; must be willing to travel; a desirable permanent position for the right man. Box 578, AM. MA.

Applications wanted from young men who have had factory office experience, preferably in motor vehicle industry, to fill vacancy requiring ability to accurately compile estimates of costs of production; apply in own handwriting and state age, nationality, experience in detail and salary expected. "W. S.," Box 565, AMERICAN MACHINIST.

Wanted—Foreman for painting department, employing forty men, turning out a high grade of work on fire apparatus, commercial vehicles, etc.; only a high grade man with executive ability considered. In your reply state age, experience, give references and state salary expected, which will be held in the strictest confidence. Box 574, AM. MA.

OHIO

Wanted—One tool room man. Box 581, AMERICAN MACHINIST.

Wanted—One mechanical engineer who has machine shop experience. Box 582, AM. MA.

Wanted—Designer and draftsman who is thoroughly familiar with presses, shears and special machinery. Box 561, AMER. MACH.

Wanted—Partner with $5000, one-half interest, manufacturing new special machine; unusual safe investment; investigate. Box 556, AMERICAN MACHINIST.

Wanted—Factory engineer experienced on the production of accurate brass machined parts in quantity; must be practical toolmaker, capable of designing tools, and to locate and eliminate the numerous mechanical leaks which develop in the casting and machining of automobile parts in brass; must be sober and energetic. Address reply to Box 564, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Draftsman, experienced on condenser, evaporator, distiller and feed water work; permanent position to the right man; state age, salary and references. Box 539, AM. MACH.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

TENNESSEE

Wanted—Operator for Buckeye oxy acetylene welding machine, one who thoroughly understands welding all kinds of repair work on cast and wrought iron, brass, copper and aluminum; $3 per day, nine hours. Atlas Machine Co., Nashville, Tenn.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

INDIANA

Designer, with technical education and broad experience with leading concerns as foreman toolmaker and chief draftsman, wants a responsible position on tools or similar work. Box 571, AMERICAN MACHINIST.

Salesman machine tools, experienced; thorough mechanic, familiar with uptodate practice; young, of good address, aggressive; milling machines, grinder or automatic machinery preferred; best references as to loyalty and ability. Box 575, AMER. MACH.

IOWA

Student, three years' mechanical drafting, wants actual drafting room experience; wages not so much of an object as permanent position with good chance for advancement; not particular about location; good references. Address "Experience," care AMER. MACH.

NEW JERSEY

Manager of works or factory superintendent would consider a change; twelve years works manager of large works on high class, medium and small interchangeable accurate work; successful organizer, able to efficiently handle a large force of men and staff; English training. Box 572, AMER. MACHINIST.

NEW YORK

Superintendent would consider a change. Box 482, AMERICAN MACHINIST.

Mechanical draftsman wishes position; various experience. Box 558, AMER. MACH.

Experienced designer of Diesel oil engines desires position. Box 557, AMER. MACH.

Factory appraisal my specialty, ten years; finish this job November 20. Box 555, AM. M.

As superintendent or manager with large concern, by man who has and is making good in this capacity. Box 504, AMER. MACH.

A-1 tool designer, technical graduate, wishes position; best of references; able to take charge. Box 547, AMERICAN MACHINIST.

Mechanical engineer having shop and office experience, is open for job in metropolitan district. Box 576, AMERICAN MACHINIST.

Designer, 15 years' shop and office experience on small and medium size automatic machinery and shop tools. Box 579, AM. M.

Expert machinist, 15 years' experience, A-1 references, desires out-door position, moderate salary. Box 569, AMERICAN MACHINIST.

Mechanical engineer, age 32, with excellent experience and record, wishes position as mill superintendent or business manager. Box 506, AMERICAN MACHINIST.

Foreman having had charge of dies, jigs and machine tools, also experimental work; thoroughly experienced on automatic screw machines. "H.," 293 Pearl St., Brooklyn.

Mechanical engineer, high-grade mechanic and designer, and expert in organization, cost reduction and increase of output, desires responsible position. Box 546, AMER. MACH.

Technical graduate, 23, with five years' experience in drafting, assisting with design and estimating on machine and construction work, desires change. Box 568, AM. MACH.

Draftsman, young man, expert practical designer for automatic machinery and tools; inventive ability; capable of prosecuting patents, wishes responsible and executive position. Box 509, AMERICAN MACHINIST.

Draftsman, experienced designer of special and automatic machines, wants to locate with reliable concern that can use speed and originality; have taken charge and successfully handled complicated work. Box 566, AM. M.

Mechanical or consulting engineer, good education, broad practical and theoretical experience, good executive, organizer and systematizer, desires executive or confidential position; would accept temporarily position as chief draftsman or designer; willing to travel. Box 521, AMERICAN MACHINIST.

Your work is increasing; you need more time for the management and a man to take charge of the shop, organize for bigger output at less cost; a thoroughly modern man in shop methods; graduated mechanical engineer, with great practice as superintendent and technical manager; state work, number of men in the shop and salary. Box 536, AMERICAN MACHINIST.

OHIO

Business executive or engineer; mechanical engineer, technical graduate, ten years' business and engineering experience; practical, progressive and inventive; consider position in Middle West. Box 562, AMER. MACHINIST.

Wanted—Position, general superintendent, works manager; entire charge foundry, machine, pattern, forge, engineering, cost and sales department, up to the minute; practical, technical; now employed. Box 567, AM. MA.

PENNSYLVANIA

Experienced tool and machine designer wants position near New York. Box 483, AMERICAN MACHINIST.

Works manager or superintendent, experienced on typewriters, adding machines, cash registers, etc., uptodate on rapid production, at present employed as such, desires change; age, 36; married. Box 529, AMER. MACH.

RHODE ISLAND

Competent mechanical engineer, graduate, five years' experience, open for engagement January 1; good systematizer; able executive and superintendent. Box 577, AM. MACH.

FOR SALE

For Sale—$15,000 worth of stock in first-class foundry and machine shop working about 20 men and doing from $2000 to $4000 worth of business per month; incorporated for $25,000, for 50 cents on the dollar. Shop located in Florida; good reason for selling. Answer if you mean business. Address "M.," Care AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

Suppose that you were a salesman representing one of the largest concerns in the country, a concern which measures its factory floor space in acres, its branch offices in the thirties, its capital in millions—

Suppose that you'd just had a talk with the general manager and he had said, "My boy, you are representing one of the great industrial organizations of the world. Come hither. Look yonder at that stretch of factory buildings, see the thousands of men employed therein, listen to the mighty sound of whirring wheels and buzzing business.

"That is US, my boy, and WE are IT."

Wouldn't you hike for your first "prospect" with confidence just oozing from every pore?

And suppose that your first stopping place was a lively little city in the Middle West that makes quite a splash on the map and that your first "prospect" was the engineer of a good-sized plant, who looked just as bright and wide-awake as the bright and wide-awake little city,—

And suppose that you walked into his office, presented your nice new card with the name and address of the Great Concern printed thereon and the chief looked at it and asked, "Are you jobbers or retailers?"—

Wouldn't it jar you?

Yet that is exactly what happened in Akron, Ohio, not a very long time ago.

Here is a concern—a really great concern—which has made itself known all over the world, through its wide-spread publicity in general magazines, as manufacturers of certain things for certain channels of trade.

Depending upon that reputation, it attempts to seek new business in new channels, and its salesmen wonder why they are not welcomed by, "Sure, we know your house well."

This is a big country—machinery men form an exceedingly small percentage of the population. A concern may be known to every other man, woman and child in the United States but it cannot get machine-shop business unless it is known to the men of that industry.

And it cannot assume any size or importance to those men unless its advertising in their paper—their technical paper—is in proportion to its size and importance.

When you go fishing you've got to go where the fish are if you expect to bring home a string. You may angle with the finest tackle and most alluring bait from the biggest boat on the lake, but if your "possibles" don't know about it, they won't come around.

A machinery advertisement in a general magazine doesn't mean much to even the occasional machinery user who sees it. It may have cost $6000 for a single insertion but the reader doesn't know nor care what it cost. The magazine is read as a relaxation from business and business at that time is like the second man in the cozy-corner—an intruder, unwanted and unasked.

Put it in a business paper that is read for business reasons by men interested in machinery business and you double the results and halve the costs.

In the business graveyard are many tombstones. And as we walk through the City of the Dead-Ones with hushed breath and reverent mien, we are struck by the remarkable similarity of many of the epitaphs. "Hath a plague visited these parts?" we ask of our guide, old Warden Bradstreet. "Yea, verily," he replies, "read yonder inscriptions." And we read—"Died of 'Everybody-Knows-Us.'"

* * *

Only reliable products can be continuously advertised.

A Sharpening Plant for Mine Drills

By F. A. Stanley

A mechanical equipment almost entirely automatic in its action for heating, pointing, upsetting, fluting, sizing and hardening rock drills, used in copper mining.

An output of several thousand drills in a day is possible with this machine.

The visitor to the Calumet & Hecla Mining Company's shops at Calumet, Michigan, finds few features of greater interest than the drill-sharpening plant, which, with its equipment of special machinery, enables a few operatives to sharpen and harden drills at the rate of about 3000 per day of ten hours. As a matter of fact the capacity of the entire drill shop is considerably greater than the above figures would indicate, but ordinarily only two of the three complete sharpening machines in the shop are operated during any given run, as these will as a rule put into shape in a short time all dulled drills coming up from the mines after any shift of men has finished work for the current 24 hours.

General Plan of the Sharpening Plant

Figs. 1 and 2 are general views in the drill shop, showing the sharpening machines from opposite ends. The machine is the invention of M. M. Morrison, superintendent of the smith shop, and is a composite affair made up of several special machines so arranged that the drill passes automatically from one process to another until again ready for use in the mines.

The scheme is represented crudely by Fig. 3, which indicates diagrammatically the general arrangement of the different members of the sharpening plant and the course which each drill pursues in passing through the series of operations which convert the dulled and therefore useless tool into a correctly sized and free-cutting implement. The process may be described briefly as follows:

Referring to Fig. 3, the dulled drills are placed obliquely on the upper part of the long conveyer belt (which is also shown in Fig. 2) and pass slowly along to the point *A* where one by one they are deposited upon a cross conveyer, which is made up of several parallel chains and holding fixtures. This conveyer passes the drill ends through the fuel-oil furnace *B* and carries them to the front of the apparatus where one at a time they enter the first machine, known as the sharpener. Emerging from this, they are automatically carried into the second machine, called the upsetter, thence to the fluter, from there to the sizer and here they are received by a second chain conveyer *B* which is placed crosswise of the plant and which passes the drill points through a re-heater and then deposits them in the hardening tank.

From this cooling receptacle the drills are fed onto the lower side of the main conveyer belt as indicated in the diagram and as they run down the long room, Fig. 2, they are removed from the belt and placed in the series of long boxes shown under the crane way.

Appearance of the Drills

The group of steel ends, Fig. 4, includes a dull drill at *A;* a drill with the four lips sharpened, at *B;* an upset drill at *C;* a drill after fluting, at *D*. The drill *E* has been through the sizer, is hardened and ready for use.

The lengths used in rock drills in the mines range from 18 inches to 10 feet 6 inches, and drills of the different lengths within the range are all attended

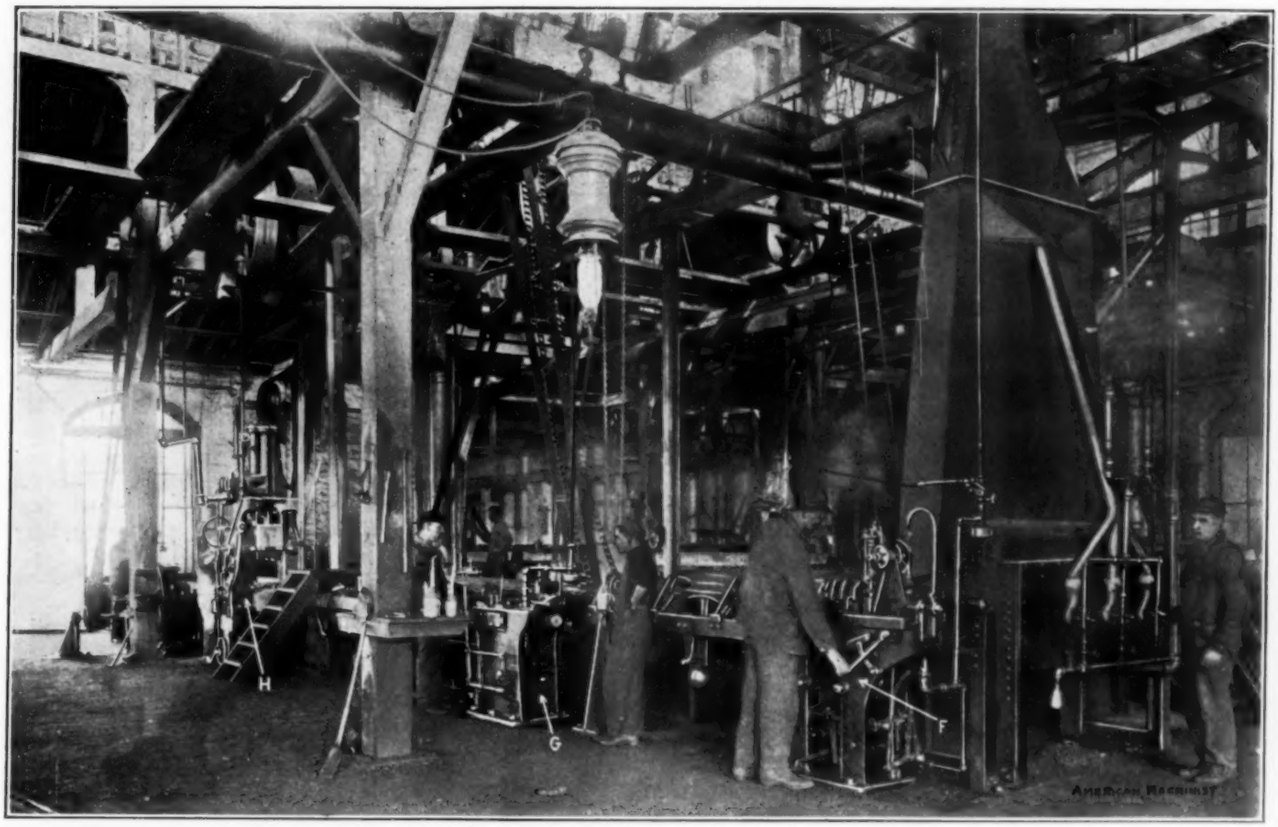


Fig. 1. Rock Drill-sharpening Machines at Calumet & Hecla Mining Company's Plant

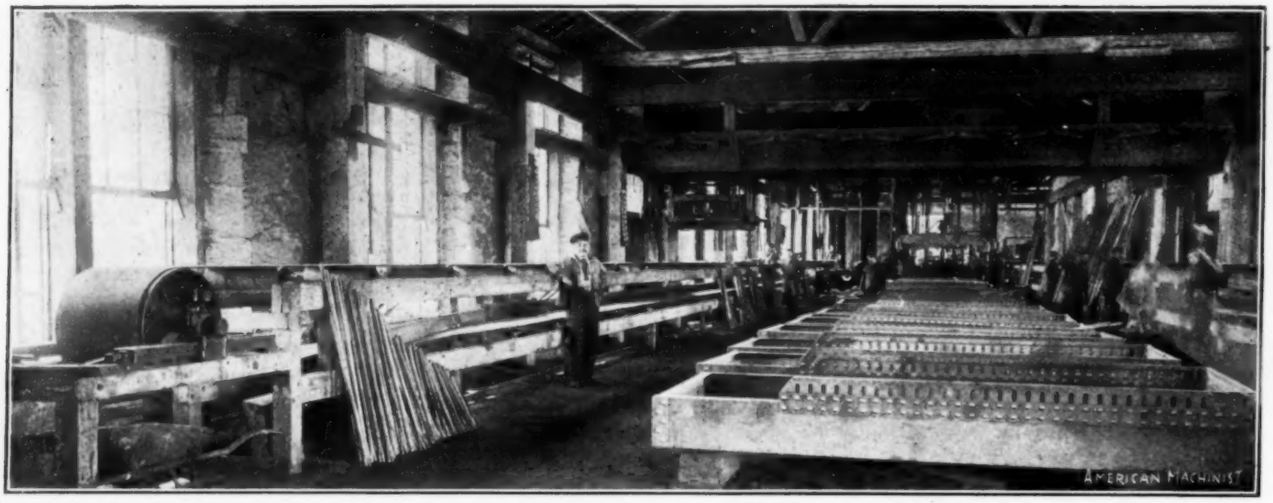


FIG. 2. REAR END OF DRILL-SHARPENING DEPARTMENT, WITH BELT CONVEYERS ON EACH SIDE

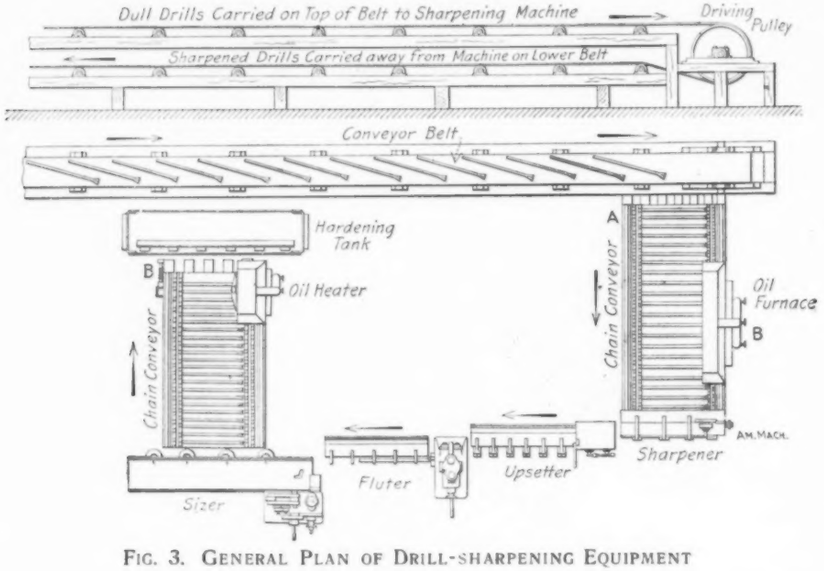


FIG. 3. GENERAL PLAN OF DRILL-SHARPENING EQUIPMENT

to on this machine without change of dies. In placing them on the conveyer belt which carries them into the machine, they are sorted by lengths as a convenience to the machine attendants, though drills coming along in a variety of lengths can be actually sharpened almost as readily as when handled one length at a time.

The conveyer belt is operated by a pulley driven by worm and wormwheel, and travels at a speed approximating 12 feet per minute; as the drills are so placed as to overlap one another they reach the chain conveyer in sufficient numbers to enable them to be fed crosswise through the oil furnace at the rate of about 5 per minute. The furnace is long and narrow and as many as 20 or 25 drill points undergo heating operations simultaneously.

SHARPENER DETAILS

In Fig. 1 the sharpener proper is seen at *F*, immediately in front of the oil furnace. This machine is supplied with a drill from the furnace by an automatic device which drops one drill into place and holds back the others temporarily. A pneumatically operated toggle acts upon a pair of gripping jaws when the operator depresses a lever and the action of the toggle is first to apply these jaws to the shank of the drill some little distance from the head and then cause another pair of jaws to seize the drill as near the fluted end as feasible. With the two sets of clamps seizing the bar in this way it is held rigidly during the first operation which consists in drawing out the four crossed lips to a V-shaped edge.

The sharpening tool is a double-acting air-operated hammer reciprocating in a vertical guide at the rate of sixteen hundred strokes per minute. The hammer first sets upon the two lips that are in horizontal position, then the drill is released from the jaws, turned one quarter way around and clamped again for the drawing down of the other two lips to a V-edge. In this hammering process, the metal is worked from the rear of the flutes and drawn down to the cutting edges by the peculiar form of the hammer and by a feeding movement controlled by a hand lever, which permits the hammer to start operations at the rear of the flute and gradually to work toward

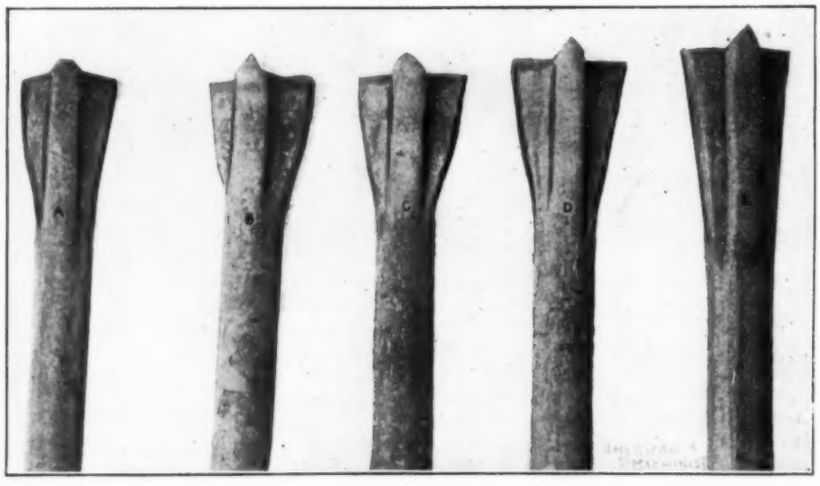


FIG. 4. ROCK DRILL, DULL AND AT DIFFERENT STAGES OF SHARPENING

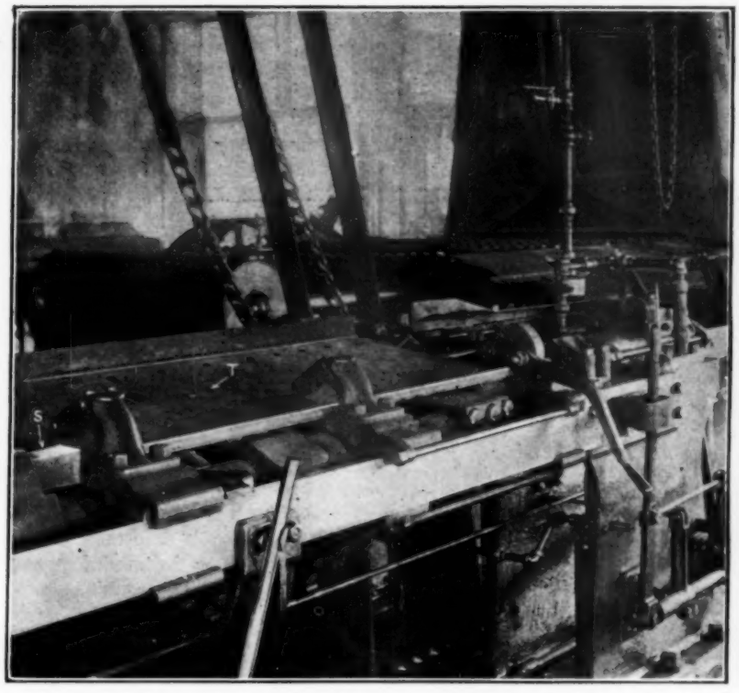


FIG. 5. THE UPSETTING MACHINE

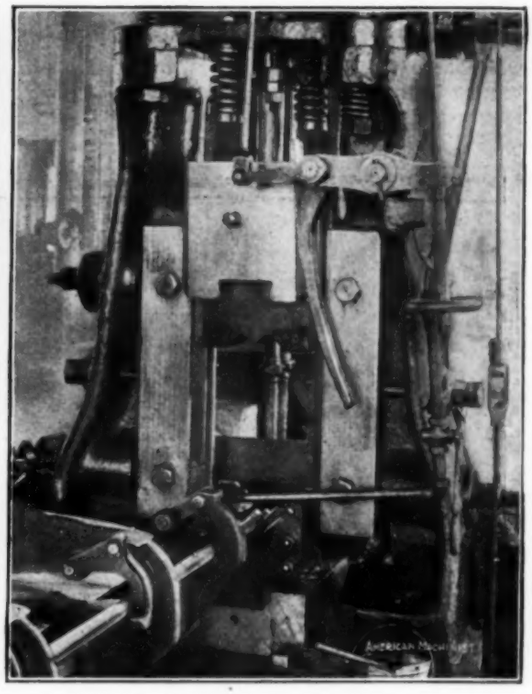


FIG. 6. THE FLUTING OPERATION

the end of the drill. The operation is a very rapid one, however, and the time required to draw out the drill lips under the sharpener, including the indexing of the work quarter way round, for the second setting, is not over ten seconds.

THE UPSETTING MACHINE

When the operator of the sharpening hammer releases the drill from its clamps by means of the foot lever, the drill rolls out onto a steel apron and is deposited upon a conveyer which shifts it endwise into the upsetter, seen at *G*, Fig. 1. At the same time a second drill drops into place in the sharpener *F* and is secured with the pneumatic device referred to above.

The upsetter *G* receives the drill and an end stop on a rotatable bar is brought up against the rear of the work by an air piston. A lever is then moved to admit air pressure behind a horizontal ram which carries at its outer end a die for upsetting the hot drill to a diameter considerably larger than is actually required on the finished drill. The work then appears as at *C*, Fig. 4.

The upsetting machine is shown by itself in Fig. 5, and this view brings out clearly the upsetting die at the right-hand end of the drill, and the levers which control the operation of the machine.

One of the four-end stops is shown at *S*, Fig. 5, with the drill end resting against it. The other three stops are located on quarters around the stop bar and are spaced 24 inches apart; the bar itself has a movement of 30 inches under the control of a hydraulic plunger and the combined adjustment of the stops effected through the rotation of the carrying shaft and its movement longitudinally enables the operator to set the device instantly to take care of any length of drill within the capacity of the apparatus.

The steel apron, which rolls the drill into the upsetting jaws, is also seen clearly in Fig. 5, at *T*. This apron is tilted after the drill is upset and released, and the tilting movement allows the drill to roll out of the upsetter onto the conveyer under the apron which carries it along to the fluter. When the apron swings back to its natural position as illustrated, it picks up another drill and rolls it onto the paws of the upsetting machine, where it lies in the position indicated in Fig. 5, until in turn upset and dropped out of the machine.

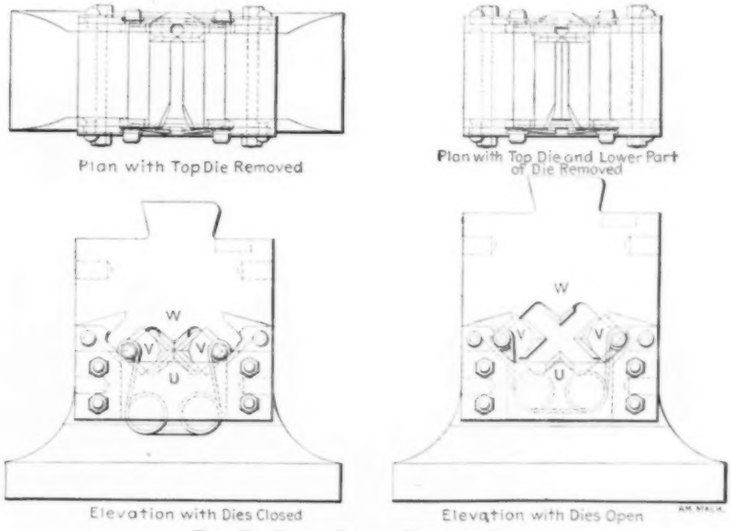


FIG. 7. ROCK DRILL FORMER DIES

THE FLUTING PROCESS

The drill from the upsetter, still red hot, as only a few seconds have actually transpired since the work left the furnace, is fed between the fluting jaws of the air-operated hammer in Fig. 6. This hammer is located at *H*, in Fig. 1. Details of the fluting dies are reproduced in Fig. 7, and it will be seen that the lower member *U* carries at the side two sliding fluting tools *V V*, which close inwardly when upper die *W* descends. Thus at each hammer stroke the four fluting edges in the dies are forced into the drill head uniformly, and a smooth symmetrical set of lips is formed, as shown at *D*, Fig. 4.

The two side-fluting tools *V V*, Fig. 7, are provided with stiff opening springs, which keep them against their sloping bearing in the lower die and cause them to rise and draw apart when the upper die lifts and permits them to follow. This detail, like others of interest, is brought out clearly by the line drawing, which represents the fluting dies in both open and closed positions.

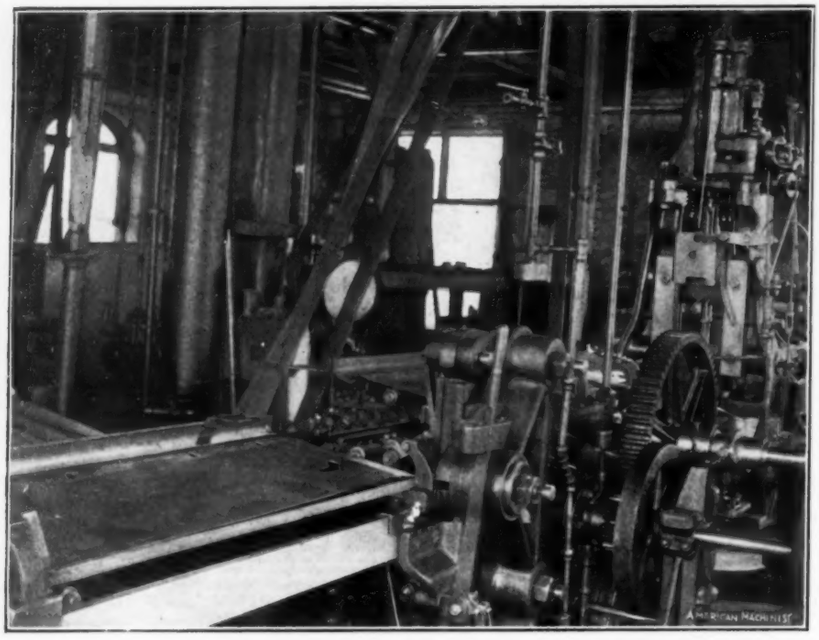


FIG. 8. THE DRILL SIZER

SIZING THE DRILL

The last machine in the row in Fig. 1 is the sizer, which is represented from the front in Fig. 8 and from the rear in Fig. 9. The sizer has a pair of squeezing dies, which act simultaneously upon two opposite lands, the drill then being turned one-quarter way round to bring the other lands into place between the dies.

The sizing dies are so mounted that they close centrally, giving the drill lands the desired angle of slope on the edge (as at *E*, Fig. 4), and producing a definite diameter in relation to the length of the drill. For, as the drills increase in length they must decrease in diameter, in order that in using the rock drill the long drills shall follow the shorter ones without possibility of sticking in the hole already drilled.

As previously stated, the drills run in lengths from 18 inches to 10 feet 6 inches. Tough carbon steel of 1⅛-inch octagon section is used and the difference allowed in sizes of drill ends is ⅛ inch for each foot of length.

Thus, a 6-foot drill is 2 inches diameter on the point, a 7-foot drill 1⅞ inches diameter, a 5-foot drill 2⅛ inches diameter, and so on throughout the complete range of lengths.

The sizing dies take care of the different lengths and produce the corresponding diameter in a very ingenious fashion. In the first place the drill slides in between the open dies, and an end stop is then run up to the rear end of the work by means of a screw actuated by friction disks, which are easily controlled by a hand lever at the front. The screw for traversing the end stop also rotates a a worm gear and this in turn actuates a vertical right- and left-hand screw, which controls two adjustable members upon which the sizing dies are mounted. Any longitudinal movement of the end gage (which is always positioned by the length of the drill itself) is, therefore, transferred at once to the sizing jaws and the degree to which these close on the drill is absolutely determined by the length of the work. In this way each drill is sized correctly, and there is no possibility of its being too large or small relatively to the length of shank.

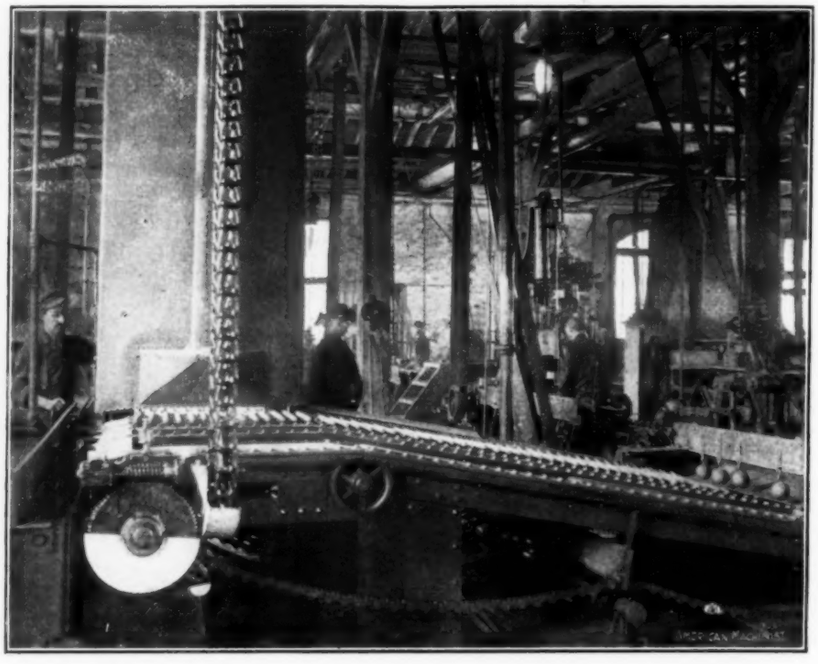


FIG. 9. DRILLS PASSING FROM THE SIZER TO THE HARDENING FURNACE

THE HARDENING STAGE

Fig. 9 shows how the drills are transferred from the sizer to the hardening tank. The actual time elapsed from the moment the drill emerges from the furnace at the upper end of the sharpening machine until it has passed through the sizer is less than a minute, and it is still quite hot when it rolls onto the conveyer, which transfers it to the second furnace for reheating prior to dumping in the cooling tank. In order that the shank shall not be hardened too far up, an air blast along one edge of the conveyer cools off the shank of the drill before it reaches the oil flame, and it is heated here only at the end and falls immediately into the tank upon passing out of the furnace. A man standing at the far side of the conveyer inspects every drill as it passes to the tank to see if it is properly heated.

The quenching tank contains clear water only, which is maintained by a circulating system at a temperature of about 60 degrees Fahrenheit.

The method of operating the conveyer by worm drive and the character of the chain links will be shown upon examina-

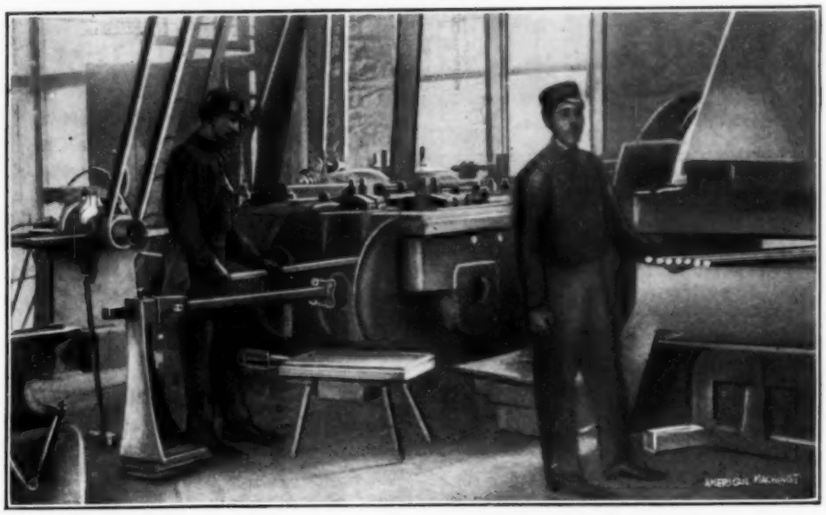


FIG. 10. UPSETTING NEW DRILLS

tion of Fig. 9. This also shows clearly a series of suspended weights of spherical form, which are placed behind the sizer to act as a stop for the drills as they roll out onto the apron. A similar stop system is utilized at the point where the drills are carried by another conveyer out of the hardening tank and onto the lower strand of the long belt, which conveys them down the narrow room to their original starting point. These suspended weights are so proportioned and spaced that they absorb the shock of the rolling drill without causing it to rebound, and they also cause the drills to roll obliquely onto the conveyer belt so that they overlap one another just as they did when loaded by hand in their dull condition on the farther end of the belt.

THE DRILL BOXES

The boxes in which the sharpened drills are deposited are represented in Fig. 2. They are of boiler plate, and two steel plates with numerous openings are attached to the sides. These, as explained by the foreman, John Hoatson, permit the lifting device on the crane to be attached at just the right point to balance the box with its load of drills, which otherwise would be a very awkward object to pick up. The crane carries an equalizing sling on its hook and the hooks on this equalizer are readily snapped into the proper openings in the drill box, so that the latter may be picked up easily and run out to the end of the building.

These boxes are used only in the drill shop, as the drills are transferred at the shaft head into steel skips, which carry them below ground to the miners.

NEW DRILL WORK

While this article relates in the main to the sharpening and upkeep of drills rather than to the making of new tools of this kind, a few words in reference to the handling of the new drills may be of interest. Such drills are produced in large numbers in the blacksmith shop and some of the operations are represented in Figs. 10 and 11. The first of these views shows the heating of the length of steel and the method of upsetting the end in the Acme header. Fig. 11 illustrates the fluting operation as performed under a steam hammer with a set of dies similar to those already described. After the fluting operation the drills are ready to be sent to the sharpening department.

The drill in its three stages, from octagon stock to fluted tool, as it appears when ready for sharpening, is shown in Fig. 12.

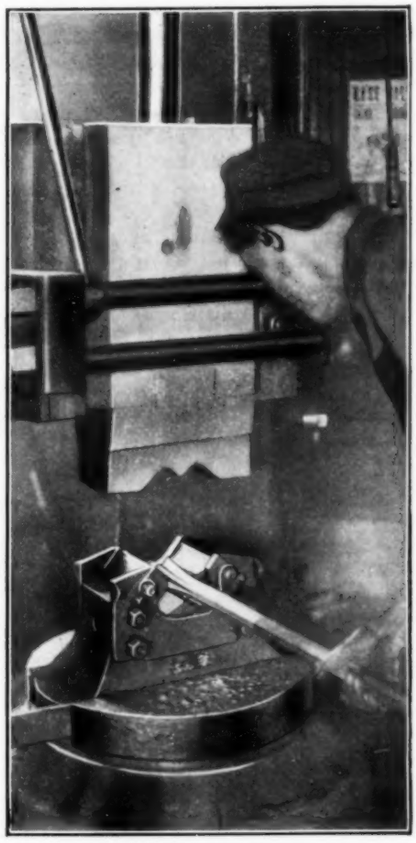


FIG. 11. FORGING DRILLS WITH FLUTING DIES

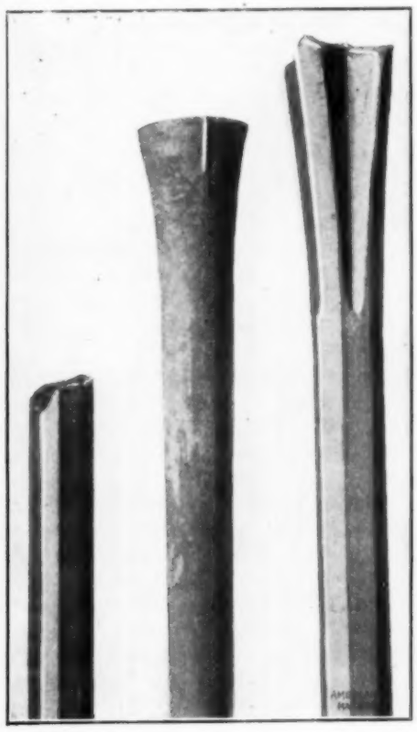


FIG. 12. THE OCTAGON BAR, THE UPSET STOCK AND THE FLUTED ROCK DRILL

Core Sands and Core Binders

The term core sand covers a wide variety of materials adapted to different classes of core work, and the conditions to be met in the core room necessitate the use of a number of grades of sand in most core rooms. In all core sands the principal heat-resisting element is silica, the silica grains also forming what may be termed the backbone of the core. Ordinary molding sand rarely contains over 80 per cent. silica, the balance being made up of alumina, oxide of iron, and other impurities. In a molding sand a certain percentage of clay is necessary to form the bond. They may be divided into bondless or sharp sands for oil-sand mixtures or cores which require a great deal of vent; and the bonded sands and gravels. The sharp sands contain from 97 to 98.5 per cent. silica, while the bonded sands contain from 97 to less than 90 per cent.

To soften up a new leather belt use castor oil. The oil does not hurt the leather in the least, and leaves a good working surface on the belt.

A Group System of Wage Payment

By C. B. Auel*

The system makes possible the reducing of labor costs by increasing the earning capacities of the workmen; its salient features and advantages.

*Assistant manager of works, Westinghouse Electric and Manufacturing Company, East Pittsburg, Penn.

Although the working of men in groups was first introduced many years ago, its use today is nevertheless sufficiently infrequent as to be new to many persons. A scheme of this kind that has been tried out on a limited scale at the East Pittsburg plant of the Westinghouse Electric and Manufacturing Company during the past four years may, therefore, possess some novel and perhaps instructive features to those interested in the increasingly important subject of wage systems.

Without going into any of the details of its development, the scheme it may be stated, is the result of a continued and consistent effort on the part of the management of the company to demonstrate *the possibility of reducing labor costs* along certain lines *by increasing the earning capacities* above a customary normal level of those actually engaged in the work. That it has been successful will, it is confidently believed, be shown in the somewhat limited account given herewith.

Starting the System

A fairly simple class of apparatus was first selected, the necessary space and tools were set aside for its manufacture, and a reliable workman was placed in charge who was familiar with all the details of construction, yet who could hardly be classed as a skilled mechanic. In making this selection it was hoped that the workman in question would, with time and proper coaching, develop some of the essential qualities of a leader or working charge-hand. He would, while continuing under the supervision of the foreman of the department in which the apparatus was being manufactured, relieve the latter of many of the routine responsibilities connected with this particular line of work and also assist in attaining the main object for which the group was organized.

As explained to the charge-hand, the scheme was to reduce the cost of this class of apparatus as a whole, both directly and indirectly; i.e., by lessening the actual labor cost of the various operations as well as by eliminating defective work and by reducing the clerical labor involved in time keeping, cost keeping, production and shipping. The labor costs already existing on the various pieces of apparatus comprising the class in question were to be taken as a standard from which to determine whether or not the scheme was to be considered successful. Any reductions in such labor costs from these figures were to be divided equally between the company and the group. The group's share would in turn be proportioned among the men according to the hours each had worked and their respective hourly rates. The charge-hand whose hourly rate was to be increased above that of any of the other men on account of his additional duties would of course receive a larger percentage of the earnings. It was also stipulated that any labor resulting in defective work would not be paid for, though any loss of material therefrom would be borne by the company. Nor would any wages in excess of the base labor costs already in existence, be paid by the company.

In these last two respects it will be noted the scheme very closely resembles piece work. The necessary help was to be furnished by the company in the procuring of raw materials, tools and other supplies and also in the shipment of the finished product. The hourly rate of each of the men was also given the charge-hand, so that in due course he could decide if from his point of view any readjustment of the class of help would prove desirable. As an aid in this respect, he was advised that in case he eventually decided that any particular operation could be done by a cheaper grade of help (even by an apprentice), the higher priced man would be removed from the group, not to be discharged, however, if he were a capable man, but to be given another position where he could earn fully as much as when working by himself before the formation of the group.

Much of the preceding information was likewise given to the workmen so that they were quite fully posted as to the plan and all were very willing to give it a trial.

Previous to putting the scheme into effect, an inventory was taken of the partly completed pieces on the floor, so that no confusion or misunderstanding would occur as to what work had or had not been done by the group. For reference purposes, the earnings of each man for the six months previous to his entering the group, were averaged and his maximum pay during this period was likewise noted, as it was fully realized that unless every man earned more as a member of the group than when working individually, dissatisfaction would result and moreover the desired reduction in costs would not be attained. The total pay of the group was to be figured bi-weekly simply from the number of completed pieces of apparatus shipped to the warehouse in such time, no account being taken of the partly finished pieces on the floor, as these would in due course go to form completed pieces when they would then be paid for in turn. The pay of the individual members of the group as previously stated was to be in proportion to the hourly rate of each and the hours each had worked, this last item being obtained directly from a daily reading of the check-board on which each member of the group must hang his check before commencing the day's work.

An Illustrative Example

To make the proportioning of the earnings rather more clear, an example has been worked out for a single pay, the group being supposed to consist of three workmen for the sake of simplicity in figuring, though actually as high as twelve men may at times be employed in a single group: Assuming the standard labor cost on a particular piece or style of apparatus to have been set at $1.10 each and that an order has been entered to build 100 such pieces, the total outside price to be paid by the company for this completed order would in no event exceed $1.10 × 100 = $110. This maximum figure would, however, be paid only when the total wages for the hours they had worked at their respective day rates, was either equal to it or in excess of it. Should, however, the work be done in less than such time, the earnings would amount to and be distributed as follows:

Check No.	Fixed Hourly Rate of Men	Number of Hours Actually Worked	Equivalent Day Rate Wages	Actual Earnings of Workmen
1	30c	100	$30.00	$42.50 } see below
2	20c	75	15.00	21.25 } see below
3	10c	150	15.00	21.25 } see below

$110 standard or limiting price for entire order
60 equivalent day-rate wages of group

2) 50 total bonus
25 bonus earned by group as a whole

$\frac{10}{20} \times \$25.00 = \$12.50$ Bonus earned by workman No. 1.

$\frac{5}{20} \times \$25.00 = \$\ 6.25$ Bonus earned by workman No. 2.

$\frac{5}{20} \times \$25.00 = \$\ 6.25$ Bonus earned by workman No. 3.

$30.00 + $12.50 = $42.50 Actual earning of workman No. 1.

$15.00 + $ 6.25 = $21.25 Actual earning of workman No. 2.

$15.00 + $ 6.25 = $21.25 Actual earning of workman No. 3.

The Computation for Several Styles of Work

If but a single kind of apparatus is being manufactured at a time, the compilation of the labor cost is an exceedingly simple matter; but even if several items or styles are going through together, their respective labor costs may still be very readily as well as very closely approximated by apportioning the total labor cost during any period among the various styles shipped during such period on the basis of the limiting prices; thus:

Style No.	Number of Pieces Completed in Any Period	Standard or Limiting Price per Piece	Standard or Limiting Price for Total Order
X	100	$1.00	$100
Y	50	0.60	30
Z	75	2.00	150
			$280

Assuming now that the total actual pay (labor cost) of the group during this same period amounted to $220, then

$\frac{10}{28} \times 220 \div 100 = 0.786$ labor cost per piece of style *X*.

$\frac{3}{28} \times 220 \div 50 = 0.471$ labor cost per piece of style *Y*.

$\frac{15}{28} \times 220 \div 75 = 1.571$ labor cost per piece of style *Z*.

There are, of course, a number of modifications which may be advantageously made at times in the scheme as outlined, depending upon the class of work to which it is applied. For example, in the case of shearing sheet-steel plates each shearman as a rule will require a helper. The latter is usually of the very cheapest grade of labor and as the shearman can be entrusted with the task of making him keep the material coming right along, there is no need of including the helper in a group. He may, therefore, be paid a fixed hourly rate, thus allowing larger earnings for the shearmen comprising the group. Again, an extra premium or bonus may be awarded the group as a whole every pay on which their total actual earnings exceed their total day-rate wages by a given percentage. While this will add slightly to the direct labor cost, the indirect labor cost will not be increased, and thus the total cost may be lowered.

Individual Initiative Not Killed

When the scheme was first considered, there was considerable question as to whether or not grouping of the men would tend to kill individual initiative. It has been proved, however, that this fear was unfounded. Moreover, there is still the same opportunity for the foreman of the department, as well as for the charge hand of the group, to observe the work of the various individuals; and if meritorious, it may be recognized by increasing their hourly rates from time to time, thus increasing their share of the earnings of the group.

In this connection it is of exceeding interest to compare the earnings of the separate members of a certain group with their earnings when working individually previous to the formation of the group; and these figures, it may be stated, while relating as indicated to one particular group, are not exceptional but rather typical of all of the groups.

Check No.	Average Per Cent. Earned of Day Rate Wages	
	For 6 months Previous to Formation of Group	For Two Years Subsequent to Formation of Group
1	131.0	150.7
2	120.6	150.7
3	141.1	150.7
4	135.1	150.7
5	137.2	150.7
6	135.5	150.7
7	121.0	150.7
8	141.2	150.7

It will be noted that while some individuals in the group profit more than others, nevertheless every member has been benefited financially by from 5½ to 30 per cent.

Reason for the Increased Earnings

In endeavoring to account for these increased earnings, several reasons are at once apparent. By keeping the membership down to a limited number, say not exceeding twelve, the men gradually become better acquainted with one another, and appreciating in due course that their interests are mutual, thus learn to help one another in a diversity of ways. Each man further feels that he is more or less observed by his fellow-workers; and, not wishing to be considered the slow man in the group, puts forth greater effort in consequence. In like manner, defective work becomes reduced to a minimum through the exercise of more care by the workmen; because as it is not paid for, no member of the group desires to have the stigma attaching to him of being the one who is the cause of reduced earnings for the group. Furthermore, as the earnings of all are directly affected by the number of men in the group, the charge-hand being even more interested than any of the others, and being also in close touch with the situation, sees much more quickly than would the foreman of the department that only such men are kept steadily at work as the conditions indicate to be necessary; thus the earnings of those who continue at work are maintained. In addition to the foregoing, it must also be obvious that the work of inspection will be materially lightened as well at its effectiveness increased, especially in the inspection of small parts, since there is no necessity of identifying the individual workman with the defective piece, it being charged against the group as a whole.

Particular stress is laid upon this last feature; for, it is believed to be one solution to the perplexity existing in most shops, as to how to inspect detail parts with sufficient thoroughness to prevent the unintentional passing of defective work without raising the inspection pay roll to exorbitant figures. The elimination of individual time slips with their attendant compilation also forms no inconsiderable part of the indirect saving, although it is recognized that some criticism may be made to the effect that labor costs cannot be obtained with the same degree of accuracy as when time slips are employed for each operation. Theoretically, this statement cannot be refuted, but practically it is believed that the difference in degree of accuracy between the two methods is much less than would be commonly supposed.

The possible applications of a scheme of this kind are many and varied; and, while it will in general be applied to the manufacture of completed pieces of apparatus involving several machining operations, there is no reason why it cannot be applied with equal advantage to machining operations alone, regardless of the parts or complete piece of apparatus involved, as for example, milling, drilling, etc.

The Salient Features of the Scheme

In concluding it may be well to enumerate briefly, the several salient features upon which the successful working of the scheme will largely depend, as well as to set down the resultant advantages where properly installed:

1. A number of workmen, not exceeding twelve, are grouped together under a working charge hand.

2. The charge hand sees that the tools of his group are always in working order, keeps his men at work and properly supplied with materials, sees that the quality of work is of uniform standard and assists in increasing the output when not otherwise engaged.

3. A limiting or maximum price is set on each piece of apparatus, the total earnings of the group being equal to their total day-rate wages for the time employed, plus one-half the difference between such wages and the limiting prices on the pieces completed; in no case, however, are the limiting prices to be exceeded.

4. The earnings of each individual in the group are a proportional share of the total earnings, based on his hourly rate and hours worked.

5. Defective work (labor) is not paid for, though the company should stand any loss of material resulting therefrom.

6. No individual time slips are issued, each workman's attendance being ascertained from a checkboard or the equivalent, upon which he must register daily before commencing work.

7. Individual merit is recognized from time to time by an increase in the hourly rate.

8. As an incentive to strive continually toward a lower cost, the group may be awarded an additional bonus whenever their earnings exceed their day-rate wages by some previously determined percentage.

9. Labor costs are approximated by proportioning the wages paid in any given period among the various pieces, on the basis of their respective limiting prices.

THE ADVANTAGES

1. Defective work will be reduced to a minimum.

2. Over-run limits, one of the greatest drawbacks of the premium system, will be eliminated.

3. Labor-cost records will be simplified due to elimination of individual time-slips and operations.

4. Inequalities in hourly rates where such exist will be straightened out much more effectively, through closer supervision on the part of the charge hand.

5. Higher average efficiency will result from team work than from individual effort.

6. There will be increased supervision without extra expense, with consequent improvement in the quality of the work.

7. By sharing the earnings each workman will help the other when difficulty or hard luck overtakes any of their number, in the shape of a complicated piece of apparatus which is given them to do, or when material proves defective after a certain amount of work has been performed on it; there will be moreover no possible cause for complaint against the foreman on the ground that he unduly favors one indirectly more than another in the distribution of hard and easy jobs.

8. The workmen will not stand soldiering on the part of any of their number, this attitude resulting in the gradual displacement of such men originally in a group as may be unsuited to the work and their replacement by more properly qualified workmen.

9. The necessity of checking for the proper quantities after each individual operation will be very much reduced, the checking of the output of each group generally being sufficient.

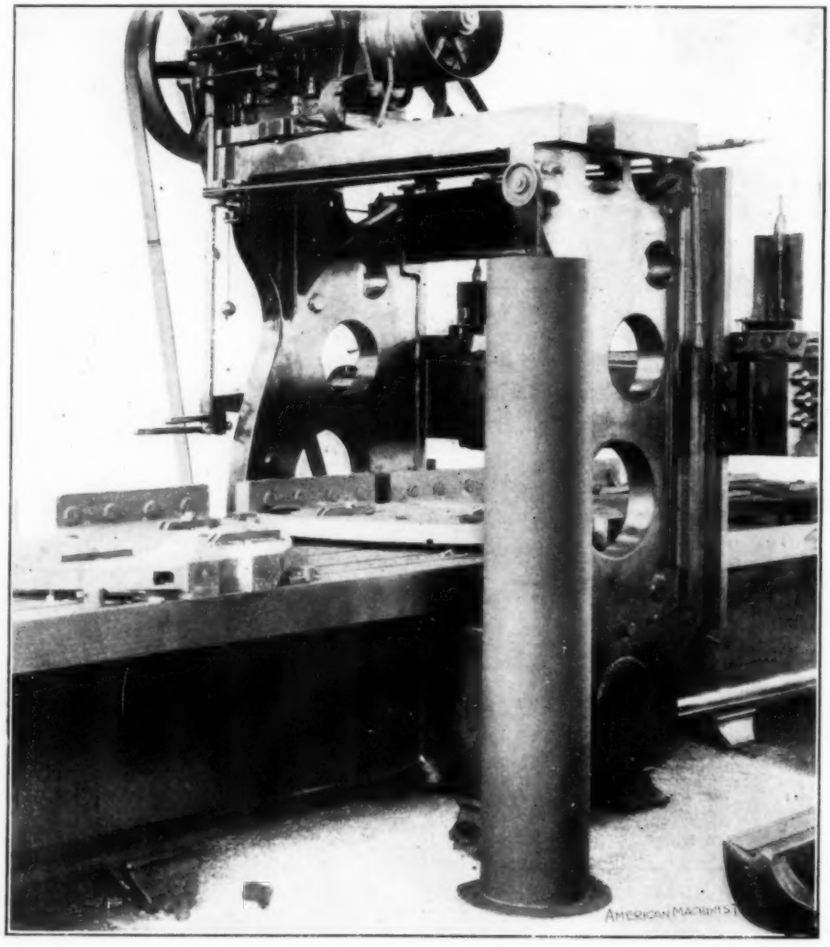
10. Inspection will be very much simplified as there will be no necessity of identifying each workman with his job in case of defective work, identifying the group being all that is required.

11. As individual operations will be combined as much as possible and a limiting price set on the completed apparatus or part, and as no individual time slips will be used, the amount of time keeping and other clerical labor will be reduced.

12. As a result of the foregoing, labor costs will be reduced, output increased and standard of quality raised.

A Counterweight Guard

In connection with the general movement toward prevention of industrial accidents, through safeguarding of machinery, adequate lighting, etc., a type of counterweight guard which the Cincinnati Planer Company has recently adopted for use in its works with all planers, boring mills and other tools having exposed, suspended counterweights, cannot fail to be of interest.



A GUARD FOR A PLANER-HEAD COUNTERSHAFT

The halftone shows this guard as applied to a planer with one side head. It consists of an electrically welded steel tube, flanged at the bottom for securing it to the floor and sufficiently large in diameter to allow the counterweight to move up and down freely. Where there are two planer heads to be counterbalanced, two tubes are placed side by side, both standing at the rear of the housing where they are out of the way. The tubes for counterweights for boring-mill rams are, of course, at opposite sides of the housings.

This form of shield presents a neat appearance, and it is obviously impossible for a workman to be caught under a weight inclosed in the manner illustrated.

The Growth of Cast Iron

It is now quite generally known that repeated heating and cooling cast iron results in a permanent growth of the casting after each succeeding heat.

On ordinary work, where extreme accuracy is not a factor, cast-iron bushings which are intended to be a drive fit on the outside, but from some cause are too small, may be enlarged by the process of heating to a bright-red heat and allowing to cool in the open air.

Sometimes it requires the second heating and cooling, or sometimes when there is an excessive growth of the bushing a little filing must be done.

There are many places, no doubt, where, as an expedient, this could be used to advantage.

Mounts and Uses for Dial Test Gages

Editorial Correspondence

Novel form of base and holder which enables the instrument to be used readily for calipering and testing flat and cylindrical pieces.

Various applications of the gage to such operations as the setting and testing of work on the planer, and the indicating of pieces on the faceplate of the lathe.

A development for the testing of deep, inside work.

Some interesting applications of the dial gages of the B. C. Ames Company, Waltham, Mass., with several new forms of mounts and holders for these instruments, are illustrated by the engravings herewith.

A Bench Device

Figs. 1 and 2 represent the gage as attached to a short arm, which is adapted to slide up and down on the vertical post secured in a large base plate. In this form the instrument is conveniently used for testing flat plates, disks and the like, as in Fig. 1, and cylindrical work as in Fig. 2. In either case, the gage may be set to a standard plug or size block, to give a zero reading at the outset, and then the pieces under inspection can be slid or rolled under the plunger, which is elevated to admit the work by means of the small handle shown projecting from the rear of the gage head.

With the gage once set to a plug or block of known thickness, it forms a bench caliper for determining the sizes of work placed under it; and in testing to hold pieces to definite limits the amount of deviation from standard, either above or below, is read at once in thousandths of an inch, according to the fluctuations of the pointer past the zero line of the dial.

Uses on the Planer

Two applications of the gage to planer work are seen in Figs. 3 and 4. The first of these represents the instrument as attached to an offset rod, which is readily adjusted upon a vertical holder and base.

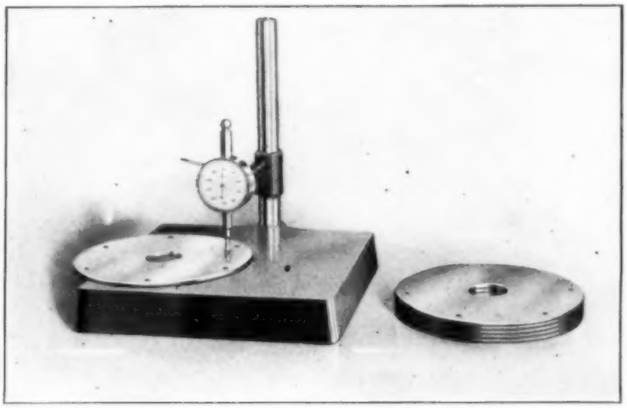


Fig. 1. Testing Thin Disks

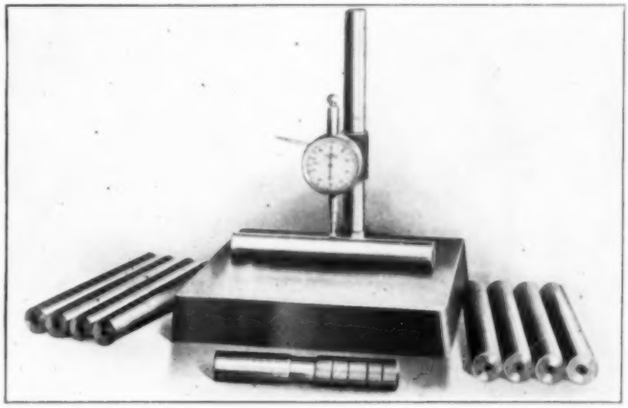


Fig. 2. Testing Round Pieces

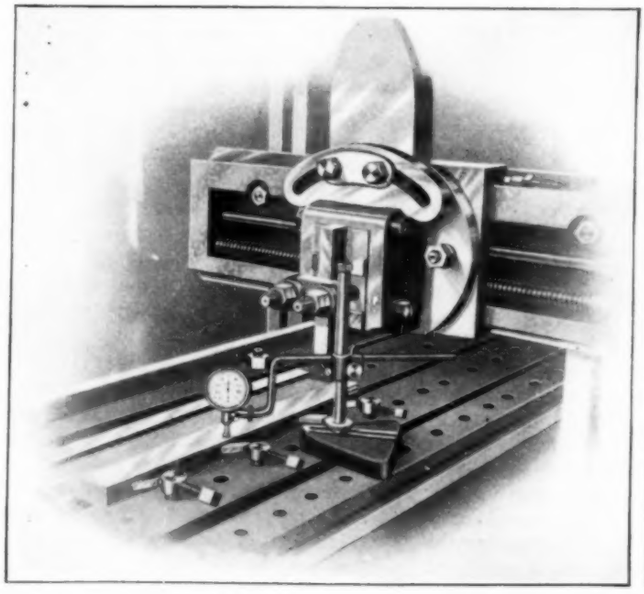


Fig. 3. Testing Planer Work

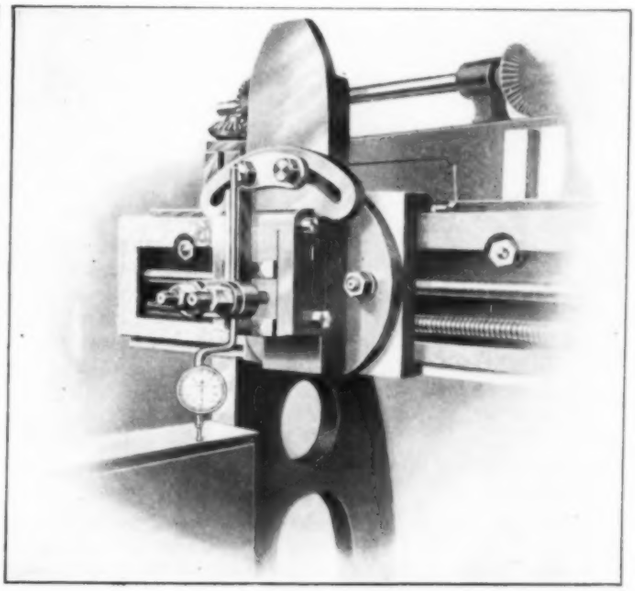


Fig. 4. The Gage in the Planer Tool Post

The gage is placed on the planer platen with the contact point on the work, in this instance a slide for a machine. It can be used in this way (by sliding it along the platen) for setting the work with its upper face parallel to the platen, or for testing the truth and parallelism of the finished piece.

In Fig. 4 the offset rod is placed in a holder secured to the clapper block and the gage is here represented, as applied to the testing of the upper face of a deep casting.

Indicating Faceplate Work

Fig. 5 shows the same gage placed on the compound rest of a lathe for locating a piece central on the faceplate by means of a center rod in a center-punch mark in the work. In Fig. 6 another lathe application is seen. Here the gage head is fitted with a bell-crank contact point for testing inside the work, to enable it to be set centrally by its bore.

It will be noted that the gage head is held in different positions and from different points in the views, Figs. 3 to 6, and it should be stated that these various ways of attaching the head to its holder are made possible by a form of universal joint, which allows the gage to be supported in the manner best suited to the work in hand.

An Internal Arrangement

An arrangement for testing bores of various depths is illustrated in Fig. 7. By means of plungers of suitable lengths and internal heads of diameters adapted to the proportions of the cylinder, inside work of any reasonable size or depth may be tested with this form of gage. The plunger in the gage head is actuated by a rod, which has a 45-degree point at its inner end contacting with a similar surface on one of the three contact plugs in the small head formed at the end of the sleeve. The other two contact points are fixed, but the one which is movable in its seat causes the gage pointer to move in unison with its own action. Thus, when the instrument is slid along the bore of the work, the extent of any irregularities found by the movable contact can be read on the dial.

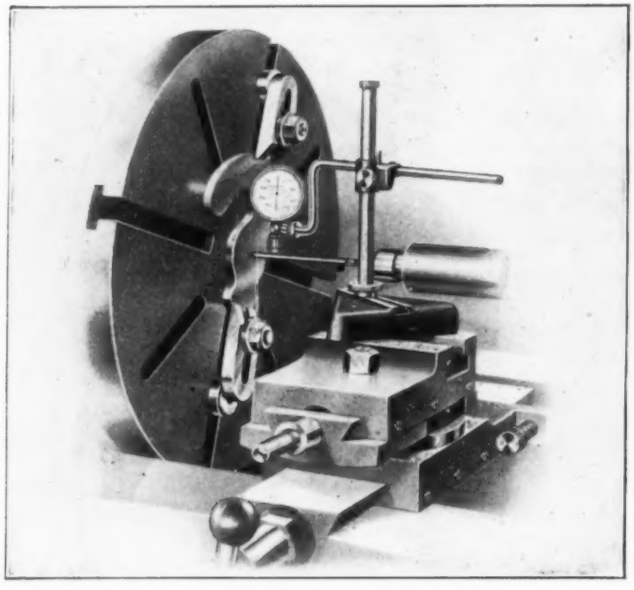


Fig. 5. Indicating Work in the Lathe

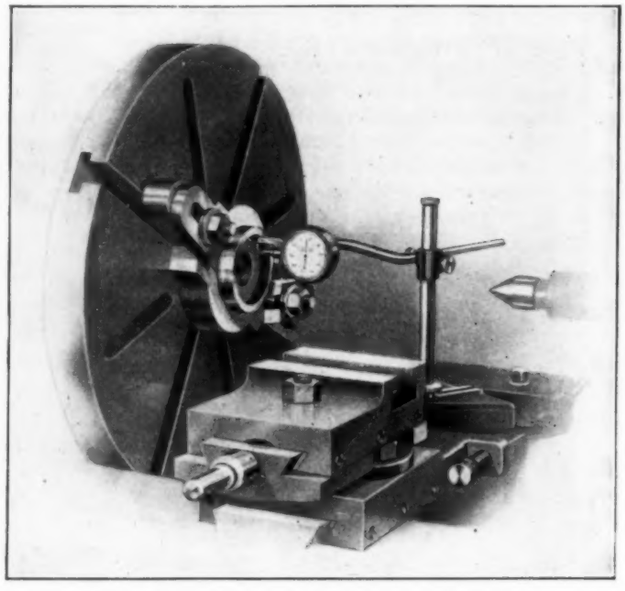


Fig. 6. Indicating Work in the Lathe

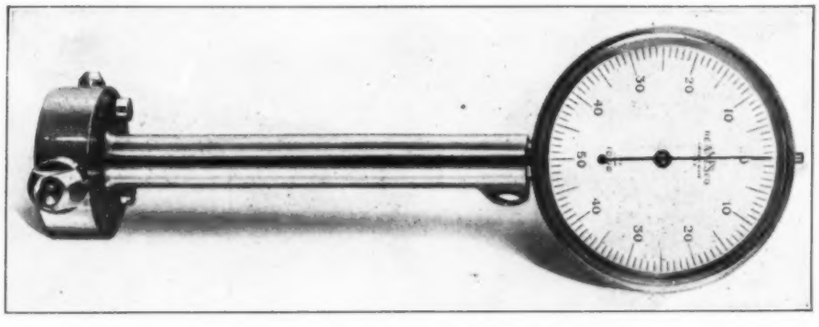


Fig. 7. Gage Arranged for Inside Testing

Use of Information in Regard to Machines and Tools

By Andrew Webster

When a new machine or tool comes into the shop, those in authority should follow up the accompanying descriptive literature and see that it reaches proper hands.

For instance, when a machine tool is being unpacked it is little short of wonderful to see how the attractive descriptive matter often disappears. It would be all right if the conjurer were the right man; namely, the man held for results. But invariably he is not the wizard, with the final outcome that the cuts and accompanying reading matter often find their way to the nursery picture gallery.

From my own observation the conclusion comes that the person chosen to operate a new machine (or new tool) should have an opportunity given him of reading the valuable suggestions and advice of the maker, as derived from his best practical experience. This plan would certainly give more immediate and satisfactory results than if the man is left to feel his way. Of course, it could be arranged that such matter would be returned to the office after use.

Referring to the output of machine tools some users consider it quite uptodate to "go one better" than the maker guarantees. The results are often disastrous.

The altering or strengthening of parts of a machine tool invites failure, from the fact that in building the parts are worked out proportionately in regard to strength. It is absolute folly to strengthen indiscriminately. I have an instance in mind where new cones were put on to

accommodate a wider belt. The increased belt pull proved too great for the machine; failure resulted. What was needed in that case was a heavier machine.

Cutting Racks on a P n

By E. A. Dixie

The halftone, Fig. 1, shows how racks are cut in the shops of the Detrick & Harvey Machine Company, Baltimore, Md. The particular job shown is the

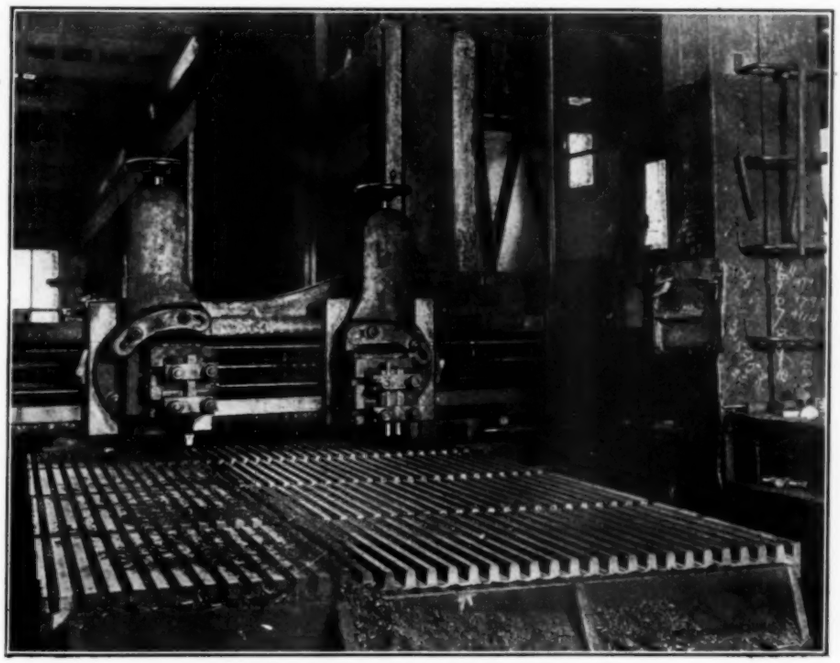


Fig. 1. Rack Cutting on the Planer

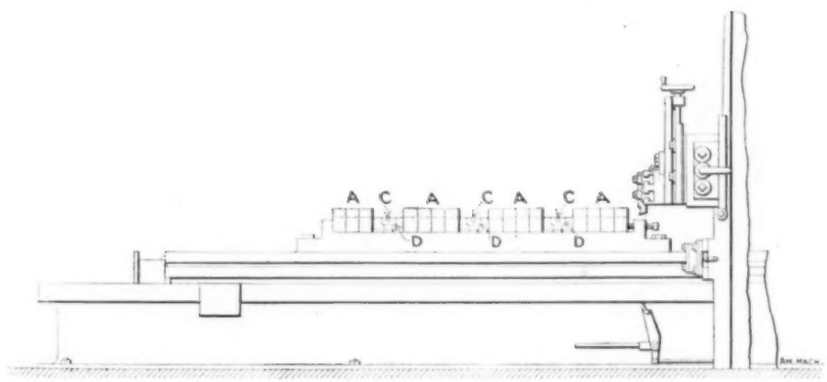


Fig. 2. The Jig and Work

cutting of 15 lengths of rack, each 5 feet long by 5¾ inches wide. The teeth are 1¾ inch pitch.

The cutting is done from the solid. The cast-iron blanks are planed in gangs on another planer. Fig. 2 shows the side view of the jig, which is very heavy and made of cast iron. The rack blanks *A* are placed as shown in three groups of 4 and one group of 3 pieces. The setscrews *B* are then tightened. Between the groups are the steel pieces *D*. When the setscrews are partially tightened the screws *C* in the steel piece are screwed down which brings the individual groups of blanks to a seat on the jig and prevents them lifting when the setscrews *B* are finally tightened.

The work is first roughened out with four high-speed tools, two in each head. In this operation there is a distance piece between the two heads to insure even spacing. The actual spacing is done with the cross-feed screw which is equipped with a large division plate. The roughing tools are shown in place in the head to the right.

The teeth after roughing are rough finished with a formed roughing tool in each head. This leaves about $\frac{1}{32}$ inch a side to be removed by the finishing tool. This tool is shown in place in the head to the left. In this operation but one tool is used. The tooth cutting takes 35 hours in all. That is to say a cast-iron rack 1¾-inch pitch 5¾ inches wide and 75 feet long is cut in 35 hours. I would like to know how long it would take to do this job with a rotary cutter.

The rack teeth are at an angle of 5 degrees. The racks are driving racks for Detrick & Harvey open side planers.

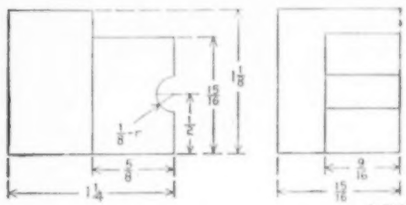
Dimensioning Drawings

By T. H. Park

There are two or three good features worthy of note shown by the illustration, which shows the practice of a company with whom I was formerly connected in regard to the dimensioning of their drawings.

It will be noted that all of the dimensions are so placed that they read the same way, across the sheet, for both vertical and horizontal distances. This feature, it would seem, might be adopted with good results in most any drawing room, as it enables the workman to see clearly all the dimensions on the sheet, without the necessity of turning the sheet on end. This enables him to hang the blueprint up over his machine or bench, and it need not be disturbed until the job is done; thus he avoids handling and soiling the print.

The inch marks are omitted in this shop also for all dimensions under 4



As the Dimensions Are Placed

feet, and when a dimension is greater than this figure it is expressed, "4 feet 6 inches." However, as very few dimensions on tool work run this large, they are conveniently expressed in inches; with this fact in mind it is a needless waste of time to add the inch marks. Furthermore, it avoids confusion due to the fact that on a dimension expressed in decimals the inch marks are frequently mistaken for a figure 1.

Another point is that the arrow head is omitted from the ends of dimension and reference lines on the drawing when penciled in, these being added by the tracer on the tracing copy. The dimension lines are drawn as shown at the bottom of the illustration. The original drawing is not filed for reference, blueprints being used for this purpose. As the original is used only until a tracing is made, all necessary work is omitted from it; hence, leaving off the arrowheads effects a saving of the draftsman's time.

The total value of motors of all kinds, including supplies and parts, manufactured increased from $19,505,000 in 1899 to $22,371,000 in 1904, and $32,037,000 in 1909, or 64 per cent. for the decade.

Method of Manufacturing Tool Posts

By C. L. Goodrich*

Economical production effected by a series of operations in which the stock is first cut to length for two posts, which are then slotted in the spline miller, formed at the ends, drilled and tapped and cut apart in the turret lathe and squared at the bottom of the slot in a new type of shaper.

The total time required for each post is only ten minutes.

*Department foreman, Pratt & Whitney Company.

The purpose of this article is to explain in detail the method used by the Pratt & Whitney Company, Hartford, Conn., in manufacturing ordinary tool posts, such as are used in large quantities on the lathe, planer, screw machine, etc.

This was not a very simple or easily accomplished job before the advent of the Pratt & Whitney splining machine and the vertical shaper. More or less elaborate fixtures were necessary according to the number of tool posts made. In small shops the slots in the tool posts were laid out singly and tediously by hand, and the slots drilled out. After this the bridges between the drilled holes were drifted out by hand, the square bottom chipped out and the slot finally finished by filing. In better equipped shops jigs were used in the drilling operation which obviated the laying out operation. Broaches took the place of drifts and with properly made broaches there was no necessity to finish the slots with the file. The final finishing cut was taken on the outside of the piece after the broaching was completed.

The accompanying illustrations will assist the reader in understanding the various operations, which are represented in sequence in Fig 1 and are as follows:

Operation No. 1 consists in cutting up bars of bright cold-drawn steel into blanks of a length sufficient for two tool posts plus the width of a cutting-off tool. This operation is accomplished in the company's No. 2 cutting-off lathe where the blanks are made two in one so as to afford room for clamping the work quickly and securely during succeeding operations.

Operation No. 2, as indicated by the illustration, consists of milling the elongated slot and for this is used a Pratt & Whitney spline miller which does the work complete without any drilling operation. While it is assumed that most readers are familiar with this automatic machine, it may be in order to state that in cutting a slot two cutters work simultaneously from opposite sides and will cut the stock very rapidly.

The third operation is the forming of the lower end of the tool post, and for this a turret lathe is utilized, the work being held in a collet while a forming tool *A*, Fig. 2, is used to shape the end to the desired contour. The forming tool is held in a block which is mounted on the cross slide of the turret lathe.

The fourth and fifth operations are also accomplished in the turret lathe and consist of beveling the upper ends of the tool posts with a forming tool *B*, Fig. 3, mounted on the cross slide, and drilling and tapping the hole for the tool binder screw by means of tools held in the turret. The cutting of the work into two tool posts is performed by a cutting-off tool carried on the cross slide.

The final or sixth operation of squaring the bottom of the tool slot is readily taken care of in the vertical shaper which has just been brought out by this company.

Tool posts of either circular or square cross-section handled in the manner described are produced at a very low labor cost and are superior in appearance to those in which the slot has been forged out or drilled and broached, both of which methods are quite commonly used. The total labor time for making one tool post is 10 minutes. The spline miller takes 8 minutes for cutting the elongated slot, but as one operator can run several of these machines, the actual time for this operation is considered as approximately one-third of the machine time, or 2⅔ minutes.

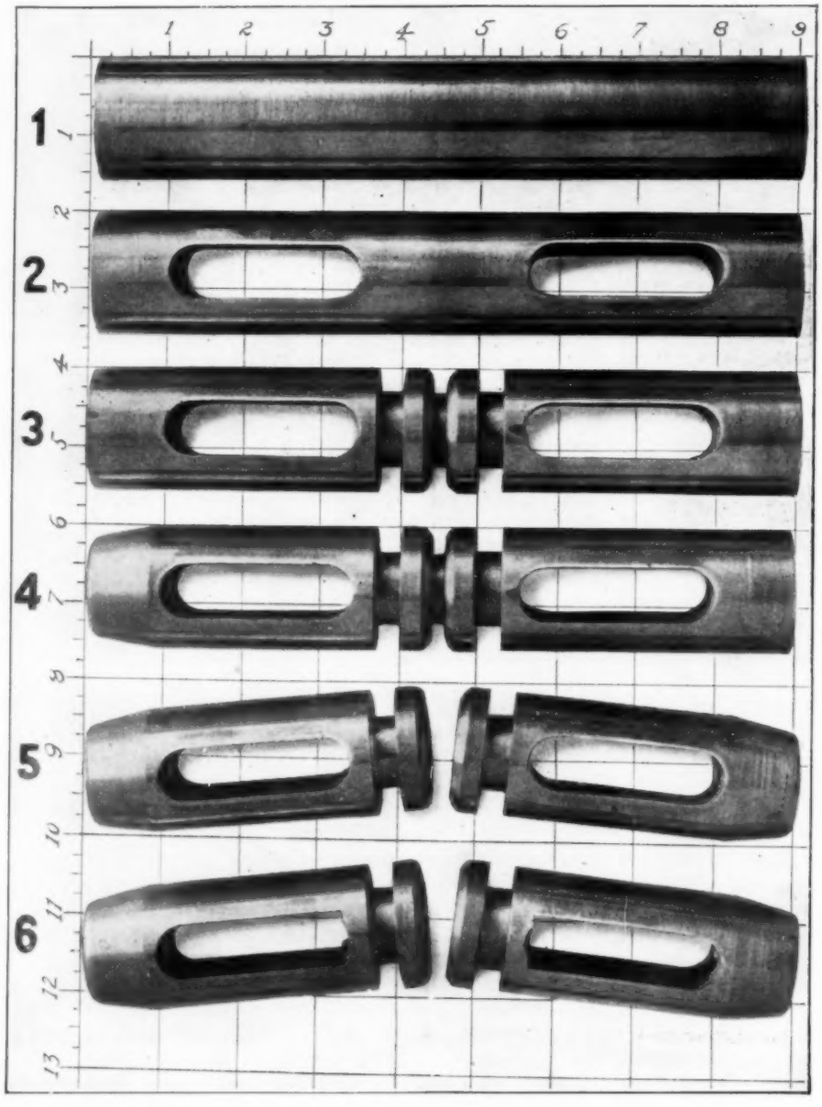


FIG. 1. SEQUENCE OF OPERATIONS IN MANUFACTURE OF TOOL POSTS

Limitations of Rope Drive

By Walter B. Snow

An investigation indicates that rope transmission has a good field where large powers are to be transmitted and the distances lie between 75 and 150 feet.

The adaptability of rope for almost every condition of power transmission has been so ardently urged by some and so vehemently condemned by others that one may well ask whether there is really any place in which it is justifiable to use the rope drive. In an effort to clear away some of the confusion and to set forth, if possible, the limitations to the efficient use of rope transmissions, inquiry was recently made in a variety of industries and among a considerable number of designing engineers. Each was asked for an opinion as to whether the use of rope was growing in relation to belts, and when and why rope was to be considered preferable to belts.

The replies to these inquiries may be roughly grouped into the following classes: Twenty-three from textile manufacturers, twenty from paper manufacturers, five from workers of metal, principally machinery manufacturers; twelve from designing and consulting engineers, and three from diversified industries. The total number of replies represents only 63 per cent. of the inquiries sent out. The fact that the replies received from the various classes is not proportional to the inquiries sent to each suggests that where the percentage of replies is low there has been comparatively little experience in the use of rope transmission. The letters present such a wide diversity of opinions that a casual reading leaves one as much confused as at the beginning. But a careful analysis and classification of all of the letters disclose some interesting and instructive groupings of opinions, and reveal more or less logical reasons for the differences in opinions.

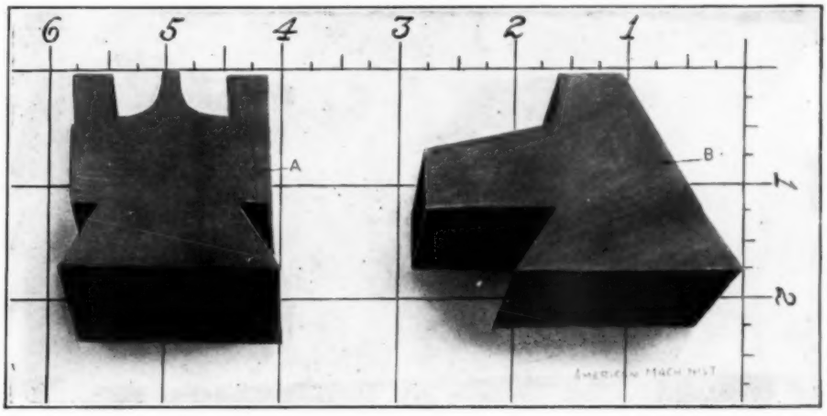


FIG. 2. FORMING TOOLS FOR TOOL POSTS

THE ROPE DRIVE HAS ITS OWN FIELD

First of all, it appears that all except the most violent opponents concede to rope a field of somewhat elastic proportions in which it is recognized to be better than belts, gears or chains. In the second place, it is noticeable that there is a relatively sharp distinction between the attitude of the consulting or designing engineer and that of the individual who is in daily touch with the operation of a rope drive. Doubtless because the former views the subject in a broader and more critical way, he sees imperfections which do not appeal to his less technical brother. In fact, the man on the job seems to encounter but a small proportion of the troubles set forth by the man who makes the plans. From this it might be assumed that the imperfections of the rope drive are largely theoretical and that they have to do with efficiency rather than with mere ability to transmit power.

Because the rope has been so generally regarded as always the rival of the belt as a medium for transmitting power between rotating members, the real fact that each has its distinct field has been somewhat overlooked. True it is that these fields overlap in many instances, but this only emphasizes the point that there are extremes in which only one of the two means of transmission ever rightly belongs.

It was freely predicted not long since that the advent of the individual motor drive would mark the passing of both belts and ropes from the power-transmission field. Indeed, many shops and mills were changed over to accommodate the all-conquering motor. But wider experience with the electric drive has demonstrated that it, too, is circumscribed in scope and cannot be specified offhand as the best. Its application is undoubtedly widespread and some remarkable economies have been effected by its use in places for which it is peculiarly fitted.

As between the two systems of rope drive, American and English, opinion seems to lean toward the use of the English system of a multiplicity of individual loops for heavy transmission as against the American method of employing one long rope looped again and again over the sheaves and then carried over a tension sheave for lighter and especially complicated drives. The essential advantage of the former and older method is that the breaking of a rope will not cripple the drive, the remaining ropes dividing the work of the broken member among them. In the American system it is claimed that equal tension is obtained in each loop and therefore perfect distribution of the power is transmitted along the loops. All the loops, being equally loaded, the possibilities of a break are greatly reduced, and it is maintained that much longer life is assured for the rope as well as greater transmitting efficiency due to the steady tension.

The variety of existing opinions regarding the use of rope for transmission which was revealed by this investigation cannot be better displayed than by quotations from some of the letters received. The superintendent of a large paper mill writes:

A FEW OPINIONS

"We use but one rope drive in this mill for the transmission of about 300 horsepower. We would like, however, to have many more rope drives if we could induce their further adoption. We believe that the use of rope transmission is increasing and our experience is that the rope transmission is receiving more attention today than it has ever done. Part of this may be due to the greatly increased cost of rubber and leather belting and to the usually unsatisfactory results obtained by the use of cotton belting on account of its inferior tractive power. The first cost in connection with the adoption of the rope is lower as compared with belts and the subsequent upkeep is smaller and the results obtained where the rope drive is adequate for the services put upon it are much better than those obtained with belts.

"While much of the foregoing consists of merely bald assertions, they are the results of hard practical experience. At the present time we are installing considerable new machinery in one part of

our mill and have arranged to use rope drives instead of belts in a place and for a service where rope has never been used before. We think so well of rope drives that we are contemplating using them wherever possible in new installation in the future."

In distinct contradiction to the preceding, although qualified by limitations, is this statement of a well known firm of consulting engineers:

"We do not consider rope preferable to belts. At best, rope transmission is only to be used in exceptional cases. For indoor work, such as the driving of machine tools, transmission of power from line shaft to countershaft, and even from the engine to the jack shaft, rope transmission at no time has been and is not now a serious rival of belts. The only cases in which rope can be advantageously used is where power is to be transmitted, say more than 75 feet and less than 150 feet. For greater distances it is probable that electric transmission would be the cheapest and best. For shorter distances than 50 feet the use of belts would be preferable."

Another paper manufacturer presents a case for the exclusive use of rope in these words:

"We use rope drives for several purposes. The largest of these is used for driving a 600-kilowatt generator, and has proved very satisfactory in every case. This is an instance where it would be practically impossible to use belts as the generator is connected direct to two waterwheels. We have several other rope drives for the transmission of power to a point too far from the source of power to be able to use any other method than electrical transmission.

"The tendency seems to be to use rope in preference to belt wherever the horsepower to be transmitted is large and where there is ample room for sheaves on the driven machinery."

In contrast is this statement from a textile manufacturer:

"We are not using rope drive. We did use this system in our old mill, but had so much trouble with irregularity of the English system of rope driving after the ropes began to wear out and new ones had to be put on, that we abandoned the rope system, and have substituted belt drive instead. From our experience we consider belt drive preferable, although it costs a little more in the first place. Rope driving, according to our experience, runs fine for a few years, or until the ropes begin to give out, when everlasting trouble commences unless the mill substitutes a whole new system for every individual drive. New ropes will not work well together with old ropes which have worn down to a smaller diameter."

Engineers' Opinions

A firm of consulting engineers summarizes its opinion thus:

"In our opinion the use of ropes is not growing. It is also our opinion that the use of belts for transmitting power is decreasing. While motors are not universally adaptable for power transmission, there are many points in their favor in such plants as we have to do with and we believe their use is increasing, with a consequent decrease in the use of belts and ropes. We have found it expedient to use ropes instead of belts for transmitting power from waterwheels and in some other cases where dampness would prevent the satisfactory use of leather belts."

Some of the reasons for these wide differences in opinion are to be found in the following somewhat explanatory letter from an engineer noted for his conservatism:

"So far as my observation goes, I should say that with the introduction and extension of the use of electric transmission, the use of rope transmission would diminish at a more rapid rate than would the use of belts. The reason for this is that ropes have been used very largely for main drives from engines, and in nearly all cases the counterdrives have been belts. With the use of electric transmission, the main drives are done away with, but the drives from the motors and the counterdrives remain as formerly.

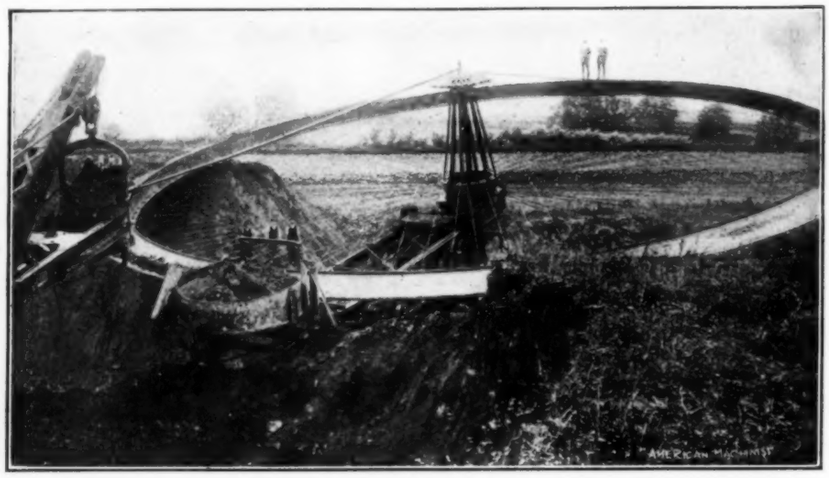
"I believe that rope transmission is preferable to belts sometimes where large amounts of power must be transmitted, such as from large engines or to head shafts in a mill. Also, the use of ropes will avoid the extremely wide belt wheels. Furthermore, in places where power must be transmitted mechanically from one building to another and around corners, ropes are preferable to belts. Electrical transmission enables the elimination of these awkward drives."

Manifestly, the limitations of the rope drive are set by those of the belt, for electric transmission may supplant either. Within the field of efficient operation of the belt the rope is a poor rival, but beyond the limits of practicable belt lengths or widths the rope finds no superior; here it reigns supreme. Such is the evident consensus of opinion.

A Novel Type of Rotary Conveyer

The accompanying halftone shows a rather novel mechanical device designed for use in excavation work.

It consists of a huge wheel, 80 feet in diameter, the rim of which forms a flat table 3 feet 6 inches in width. In the center of the wheel is a light steel-work hub, to which the rim is supported by 224 steel-wire radiating spokes. The wheel is mounted on a substantial pedestal carrying the driving mechanism, which in turn is carried on a heavy-wheeled trolley. The hopper shown, which is driven by the same engine as the wheel, discharges its load automatically upon the rim of the conveyer. When the steam excavator bucket deposits its charge into the hopper, the material is swung round until it is brought to the transporter wheel through the opening in the outer wall of the hopper.



Novel Type of Rotary Conveyer

The conveyer in its revolution carries round with it the earth until it comes in contact with a scraper so placed as to deflect the material off the table at any desired points.

A small boiler and steam engine are housed on the turntable, to which the entire outfit is attached, and provides the power for driving the hopper and wheel as well as propelling the conveyer, along its track.

A departure in the moving-picture industry, now such an important part of the public's amusement, is to be the presentation of industrial moving pictures. The first subject to be taken up is the manufacture of typewriters, and a film-record of the Remington Typewriter Works has been made and will be exhibited in 10,000 theaters throughout the United States, Canada and Europe.

Making Paint in the Shop

By S. M. Henry*

The advantages and savings made in mixing paints in the shop where they are used, with a description of the necessary machines and appliances, and the help required. The examples are shown from a shipyard.

*Naval constructor, United States Navy.

In some manufacturing plants it is desirable to make the paints used, buying what may be considered the raw materials, though some of these materials have already undergone operations which in a regular paint manufacturing plant would not be necessary before the actual manufacture was taken up.

There are several reasons for manufacturing paints in this way, which exist to a greater or less degree in all large commercial plants. A large number of colors and mixtures are required which are made up from a comparatively small number of raw materials. It is, therefore, necessary to carry a much smaller stock of paints on hand with a corresponding reduction in the amount of money invested. A second reason is based on economy and exists only to the extent that the raw material can be purchased and worked into the finished product at a less cost than the ready-mixed paints of the quantity and in the containers desired can be purchased. While an annual contract could be made for the delivery of all paints used in the quantities desired, a limited amount of mixing would still be necessary to cover special requirements or for immediate use.

A reason for manufacturing paints in this way that is sometimes the principal consideration is the difficulty of buying ready-mixed paints of the quality desired. Inspection is difficult to make and the quality obtained on the first order may not be maintained unless the most careful analyses are made. The temptation to use cheaper substitutes in the mixed product is very great. Raw materials can be bought and inspected more easily and with greater certainty.

Process Differs from Commercial Practice

When paints are manufactured in large quantities the dry pigments may be ground with the necessary oil, and run directly into the mixers to be combined with more oil, turpentine and dryer. The small manufacturing shop, such as may be found in a shipyard, takes the pigments already ground in oil and combines them in the required proportions with the thinners.

It is a natural question to ask why, if the pigments have already been ground, it should be necessary to re-grind them; and in the case of combinations of white zinc and lead it does not appear to be necessary. When a color is being made grinding appears to be required as otherwise small lumps of one of the ingredients may remain after mixing, which will work out under the brush and leave a streaked surface.

The actual manufacturing process consists then, in mechanically mixing the ground pigments with the necessary oils, etc., for white paints, and the same mixing for colors with an additional grinding to insure a uniform product.

Product of the Plant

In considering a small manufacturing shop of this nature all of the output must be taken account of as it will generally be found to include much besides the main product. In this particular case it may be considered to include the following:

(1) Paints that are mixed only;
(2) Paints that are mixed and ground;
(3) Special paints mixed by hand;
(4) Shellac;
(5) Putty;
(6) Linoleum cement and miscellaneous.

The first two items are the only ones that can be considered as the real output of the plant. It will be necessary to consider in the system of keeping costs the relative time consumed per gallon or per pound on each class of work.

Design and Arrangement of the Plant

The successful manufacture of paint, once having determined the ingredients from which it is to be made, consists in little besides the economical handling of materials. Therefore, in the layout of the plant special consideration should be given to eliminating all unnecessary handling or shifting of raw materials.

The oil and turpentine, which are used in large quantities, should be purchased in either carload lots or barrels, depending on the stowage available and the cost delivered by these two methods. When cars must be delivered on car-floats it is probable that delivery in barrels will be the cheapest. The stowage tanks should be connected by piping to a convenient position on the charging platform and there fitted with hand pumps. The tanks may be located underground outside of the shop and close to the railroad track, so that the cars or barrels can be emptied directly into the tanks without the use of pumps. The dryer being required in much smaller quantities, can be bought in barrels and stowed in a tank in the shop. Lead and zinc, ground in oil, should be obtained in either 100- or 200-pound kegs, as the smaller sizes cost more and involve more work in opening, while the larger are too heavy to handle economically and involve weighing out a part of the barrel to make up the required charge, which is a slow process. On receipt in the shop the kegs of lead and zinc should be placed so that the least amount of handling will be required to get them to the particular mixers to the used.

The materials just referred to include all that are required for mixing standard white paints and are referred to here in connection with the layout of the plant.

The mixers should be arranged in a row at the edge of a platform of sufficient width to allow storing one charge for each mixer directly in its rear, and still leaving ample room for the men doing the mixing.

The sizes of the mixers will depend somewhat on local conditions, though there seems to be little advantage in going to a capacity of less than 60 gallons. For the greater part of the work it would seem that mixers of 75-gallons capacity would not be too large. The mixers being arranged in a row, are operated from a common shaft driven by a constant-speed motor and the rotating blades should make in the neighborhood of 45 revolutions per minute, this speed being limited by the splashing of the paint, though covers must be fitted, as a speed sufficient to break the lumps of pigments from the blades of the machines will splash the paint out of the mixers when not fitted with covers.

Below the mixers, the mills for grinding may be located slightly forward, so that the paint is run directly into them; the top of the mills being on a line with the bottom of the mixers. Similarly below the mills should be placed receivers or tanks of the same capacity as the mixers; this seems to be a point sometimes overlooked. The tanks being made to hold 20 or 30 gallons require to be constantly watched while drawing off a single batch, and it becomes necessary to otherwise promptly dispose of the output of the particular mixer when perhaps the time cannot well be given to it. Or the mixer has to be shut down to wait until time is found for the relatively slow operation of filling the cans. The faucet fitted at the bottom of this tank should be especially adapted for the work and of the molasses-cock type. A common faucet becomes clogged and does not allow the paint to flow freely. Below this tank should be sufficient room to take the

largest type of container to be filled resting on scales. If the paint is not to be ground the mill can be removed and the paint run directly from the mixer to the receiver.

It will be seen that vertical hight must be provided for the final containers placed on scales, a tank of capacity not less than that of the mixer, the mill and the mixer. This means that a high ceiling is necessary and that the charging platform should be about eight feet above the floor.

Handling and Stowage of Materials

As previously mentioned, economy in a shop of this kind is dependent largely on handling the materials cheaply and this means handling them few times.

With a shop of six mixers an output of not less than 300 or more than 800 gallons may be expected, with an average weight per gallon of 18 pounds. This means that between 2½ and 6½ tons of raw materials are to be handled into the mixers and an equal amount to be handled away from them.

A consideration of the path of this material will show that at best it must be handled a number of times, and if not carefully considered a large amount of needless work may be done. Assuming the material to arrive on a car at the door of the shop in barrels and kegs, it must be unloaded and landed somewhere in the shop. This much material occupies a good deal of floor space and should be put as near the charging platform as the layout of the shop permits—from here it should be moved in the quantities forming the charges to the platform in the immediate rear of each mixer and the containers opened. This is the second move. The third move is the emptying of the kegs, which involves lifting them to a block or bench alongside of the mixers and tipping them up. From the mixers the paint runs directly into the mills, then into the large containers and then into the cans—these, as filled, must be piled up and this forms the fourth move. The cans are here soldered and then restacked and perhaps moved to the shipping space. This is the fifth move. The sixth and last move is loading the filled cans on the cars.

With as small a plant as the one described, the six moves outlined may involve handling as much as 39 tons of material per day, all of which is done by hand in comparatively small containers. It will be seen that the greatest opportunity for saving lies in reducing, if possible, the amount of this handling, and in so systematizing the necessary part as to reduce its cost.

Mixing

The mixing of the paint is done by the only skilled man required in the shop, so that as much as possible should be done for him. The skill required consits in checking the ingredients to insure the proper proportions, in insuring the proper mixing and in deciding on the time when the contents can be drawn off. In addition to this he can actually put in the charges, though the opening of the kegs and placing them close to the mixers should be done by one of the helpers.

There is, perhaps, no single operation in the paint-manufacturing shop that has so great an influence on the output as the time that the mixing is carried on. This can probably never be done in less than 15 minutes, and should, on the other hand, never take over an hour. Within these limits the time will vary with the type of machine and the condition of the pigments used.

As long a time as two to five hours is sometimes used up in this mixing, probably due either to a type of machine not designed for the class of work or else too slow speed of rotation of the stirrers. If the type of machine designed for mixing pastes is used, the speed will be found too slow and the distances between the arm of the stirrers so large that proper mixing is not obtained, or if it is, too much time is used up.

In putting in the ingredients the pigments should not be put in first, but about five gallons of oil or other vehicle should go in, then the pigments. When all this mass is well kneaded to a uniform consistency the blades should be cut down, cleaned off and the thinners gradually added.

Drawing Off, Sealing and Marking

The time at which the mixed paint can be drawn off is, perhaps, the most important point to be decided by the man in charge of the mixers—this is sometimes done by drawing off a sample and weighing it or simply by looking at it to see that it is of uniform consistency, and free from lumps.

The large container into which the paint is run either from the mixers or the mills, is fitted with a molasses cock for convenience in drawing off.

As the cans are filled, the small covers are laid in place and the cans piled up in the immediate vicinity of the mills; later they are soldered without being moved and are then placed at the point from which shipment is made.

When the cans are stenciled, this is done before filling them. When labels are used, they are put on as the last operation.

Shipping

The shipments in this type of plant are quite different from a commercial paint-manufacturing establishment. In the latter case, the cans must be boxed and collected together until complete orders have been assembled, while in the case of a small shop forming a part of a large establishment, deliveries can be made directly into store. Boxing is elimated and no necessity exists for holding any portion in the shop. Shipments can, therefore, be made daily of the output of the previous day, and the same car or wagon can, on calling for the completed product, deliver the necessary raw materials. This does away with the necessity for large stowage space in the shop, and the handling that would be involved.

Number of Men and Their Duties

The number of men required for the work of the shop is largely fixed by the number of mixers in use and the extent of the incidental work required.

Experience in the shop seems to show that seven men are required, including the man in charge. The man in charge is rated as a first-class painter and is responsible to the master painter of the yard for the work of the shop.

The only other painter employed in the shop is in charge of the mixing—he is responsible for putting in the proper ingredients and for carrying on the mixing for the required length of time.

Drawing off the paint when ready, watching the mills and filling the cans take a greater part of the time of one man; while another is assigned to soldering the tops of the cans and stenciling them—these two assist each other. Another helper or laborer mixes the putty, shellac and small quantities of paint required for immediate use in lots not large enough to put in the mixers. One other laborer assists any of the above, according to the condition of the work, assists in loading and unloading materials and cleans the shop.

Laying Out the Work

On receipt of an order for the manufacture of paint, the man in charge of the shop makes out an instruction card, giving the name of the paint, the quantity required, the type of the container, the mixer to be used and the ingredients of each batch.

These instructions remove from the man doing the mixing the necessity of remembering what the different paints are composed of and insures a uniform product. In facilitates the helper getting the charges ready and placing them near the mixers.

At the time of making out the instruction card a small "standing order," giving in brief the same information, is made out and hung on a board in the office, which shows the work in progress and that which is still to be taken up.

Cost of Making

It is probable that the cost of making paint as outlined above has at times reached as high a figure as 12 or 14 cents a gallon, while with systematic operation it should be reduced as low as two or three cents. So it will be seen that even as small an element of a large plant as the paint-manufacturing shop may be well worth looking into.

Accurate Driller Work

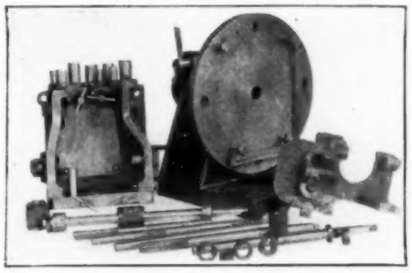
By Ralph C. Thompson*

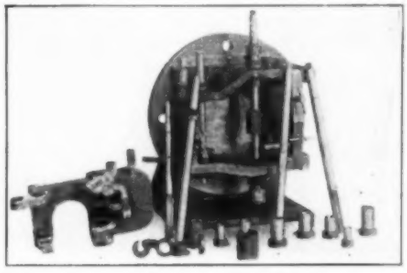
The design of jigs to insure accurate reversing, in the manufacture of automobile-engine parts; some examples and their operation.

*Chief tool designer, Seager Engine Works.

In designing jigs for driller work, especially in gas-engine and automobile manufacture, it is often necessary to provide an accurate means of reversing the jig. This is particularly true of work which has two holes drilled and reamed from opposite sides, which must line up accurately and be in proper relation to the balance of the piece. One of the commonest examples of this is found in the pistons of gas and gasolene engines, where the work of crossboring the piston is done on a driller; another common case is an exhaust-valve bracket, such as is shown in the accompanying photographs, Figs. 1 and 2, and many other cases will present themselves to the mind of the machinist.

Probably the most commonly used way of accomplishing this result is to machine supporting lugs on the two opposite sides of the jig parallel with each other, and trust to resting the jig on one set of these while drilling from one side, then inverting the jig and resting on the second set, while drilling from the other side. This method, while accurate when sufficient care is used, is open to objections when production on a commercial basis is desired, and particularly so with large jigs.





FIGS. 1 AND 2. EXHAUST-VALVE BRACKET, JIG AND INDEXING FACEPLATE

It is often hard to design the jig so that parallel surfaces may be obtained in the proper position without interfering with necessary clamping devices or bushings. Again, if the jig is large and heavy, the man on the machine is prone to handle it roughly in turning it over, and this quickly destroys the accuracy of the supporting surfaces; also, if a chip happens to be left on the table of the driller and one of the supports is allowed to rest on it, trouble will be caused.

THE DIFFICULTIES OVERCOME

At the Seager Engine Works, of Lansing, we have overcome these difficulties in many cases by mounting the jig on trunnions in a base plate and providing a means of indexing the jig to different positions accurately and quickly, and also holding it in any desired position with sufficient firmness to permit of rapid work. Figs. 3 and 4 show one of these jigs for the main frame of a 1½-horsepower gasolene engine, and also the tools used with the jig. All the machine work required on this casting is done in this jig, with the exception of boring the cylinder, and drilling and tapping for the main bearing studs, which operations are done previously.

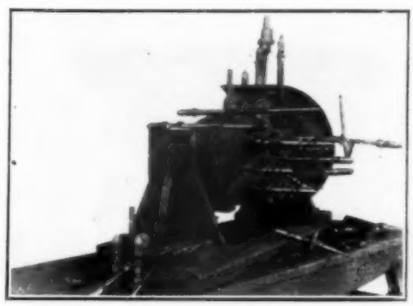
The bed is shown in the jig without the main-bearing caps, in order to show the bar which is used for alining the bed in the jig; this bar is removed and the caps placed on the bearings and the babbitt is reamed to size, then a double-ended facing tool on a bar, arranged with stop collars at each end, is used to face the inside faces of the main bearings to length. This work on the bearings is done so accurately that no fitting is required when assembling the crank shaft and bed, except scraping the fillets, and this only when the radius on the crank shaft varies from standard.

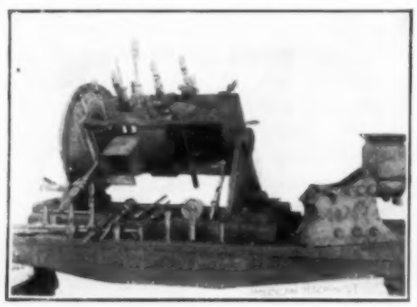
After this operation is finished a second bar, similar to the one used for alining the bed, except that it is large enough to fit the bearings after reaming, is placed in position and this insures that the bed is held rigidly from the cylinder bore and the main bearings while the balance of the work is performed. All holes are drilled and reamed or tapped, the valve-cage holes are reamed and faced, and the bosses for the valve mechanism are drilled and reamed and faced both inside and out; when the bed is removed from the jig it is finished ready to assemble.

This style of jig gives entire satisfaction, and in large jigs which are in use for a major portion of the time is eminently suited to this class of work, but we were also confronted with a number of parts which really required to be handled on a jig which could be indexed accurately, and of which we did not make enough in a year to warrant the expense of a jig of this type. Also on smaller pieces it was desirable to have the indexing mechanism take up only one side of the jig, in order to have the other entirely open to permit the ready insertion and removal of the work, and to give ready access to it when in the jig, thus facilitating the use of facing tools for inside bosses and kindred operations. Taking these things into consideration, I was led to design the indexing faceplate and type of jig shown in Figs. 1 and 2.

MACHINING THE VALVE BRACKET

Fig. 1 shows the faceplate with the jig removed, and the jig and tools for machining an exhaust-valve bracket for a 20-horsepower gasolene engine. As is readily seen, the fixture consists of a cast-iron faceplate with a long hub, which is supported in a bearing on the baseplate (in the jig shown the faceplate is 18 inches in diameter and the hub is 5 inches in diameter by 9½ inches long).





FIGS. 3 AND 4. JIG AND TOOLS FOR MAIN FRAME OF ENGINE

The assembly drawing, Fig. 5, of the baseplate (in the jig shown the faceplate construction of the indexing mechanism and the clamping device. The faceplate is provided with hardened and ground taper bushings, which are engaged by a taper-ended locking pin, sliding in a long cylindrical bearing in the base.

This piece is forced forward by a stiff coil spring, and is withdrawn when it is desired to turn the faceplate to another position by a half turn of the lever at the rear of the fixture, which actuates a small edge cam that withdraws the locking pin and holds it in the "out" position, thus leaving the plate free to turn. When the plate is in the desired position this lever is thrown over, releasing the pin which enters one of the taper bushings, locating the plate exactly.

Then the clamping lever is tightened, which draws a taper wedge bored out to match the hub, in over the hub, thus forcing the rear end of the hub against the bottom of the bearing and securely locking it there; as the weight of the faceplate and jig, and the thrust of the drill hold the front of the hub down, the slack in the bearing is taken up and the faceplate is brought exactly square with the base of the fixture, thus insuring accurate work.

The two straight-edges at right angles to each other and parallel to diameters drawn through the locating holes in the faceplate, form a convenient and accurate method of locating a jig on the faceplate, where it is then clamped by the studs shown. It is readily seen that any jig having two finished edges at right angles to each other, can be placed in the angle formed by the two straight-edges and touching each of them, and thus be located on the faceplate with accuracy.

In designing jigs to be used with this fixture, we make provision for fastening them to the plate by means of studs and nuts, thus doing away with clamps; but we also use jigs which were designed previous to this by putting special clamping studs in the plate and using machine-steel clamps forged to fit.

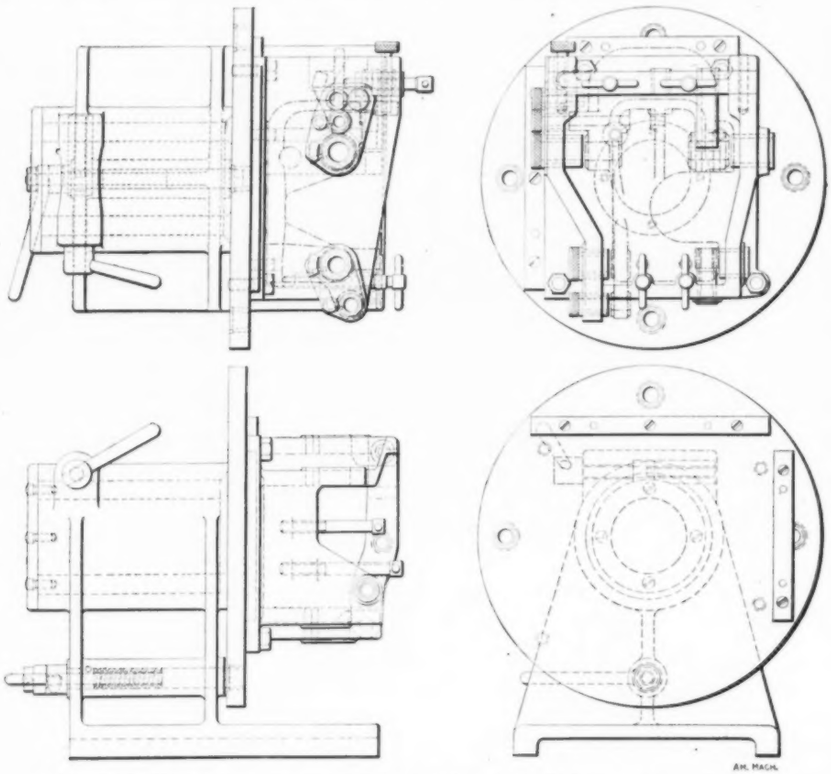


FIG. 5. JIG FOR DRILLING SHAFT-BEARING HOLES IN EXHAUST-LEVER BRACKET

THE BRACKET A DIFFICULT PIECE

The bracket shown in Figs. 1 and 2 is a rather difficult piece of work, as is shown by the accompanying drawing, Fig. 6; for the holes through the main bosses must line up accurately, and the inside faces of the bosses are held to close limits, as shown. The piece is first milled on the top face and then the four holes in the flange are drilled in a jig, not shown, which locates them properly from the rough casting. Then the piece is located on a milling fixture by these holes, and the faces marked *F* on the drawings are milled; this leaves the balance of the drilling and the inside faces of the main bosses to be machined in this jig.

The bracket is located in the jig by the four dowel pins shown, which fit the holes previously drilled and reamed, in the flange, and as these same holes are used to locate the part on the milling fixture, accuracy is assured.

The shaft holes in the main bosses are rough-drilled $\frac{1}{16}$ inch undersize, and then a boring cut is taken with the bar with a single cutter, shown in the photographs, Figs. 1 and 2, which is guided in slip bushings above and below the work, thus assuring a high degree of accuracy. This cut brings the holes to about 0.005 inch below size, after which the holes are reamed with the long special reamers shown.

Fig. 2 shows one of the double-end facing tools for the inside faces of the bosses, in position in the jig. Fig. 1 shows this tool disassembled.

THE REST OF THE WORK

The rest of the work on the piece is done with standard drills, reamers and taps, which are not shown. Slip bushings are provided for all tapped holes and the piece is machined complete, ready to assemble when taken from the jig.

The main-shaft holes come in line, and within 0.001 to 0.002 inch of parallel in 18 inches, and as the boring bars and reamers are guided entirely by the jig, this accuracy is not affected by the accuracy of the driller. In use all the tools are provided with collets for the "wizard" quick-change chuck, the same as the tools shown in Figs. 3 and 4.

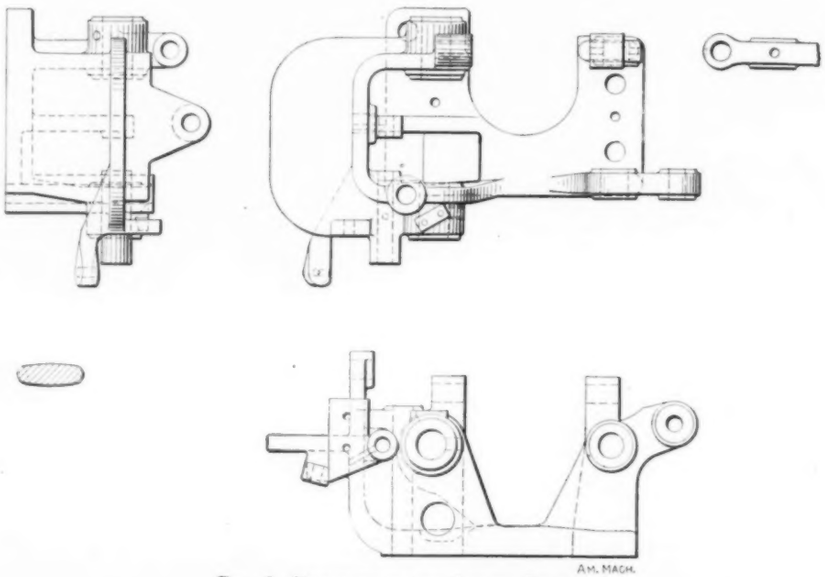


FIG. 6. EXHAUST-VALVE LEVER BRACKET

Milling Fixtures Used in Motor Car Work

By T. B. Gray

Fig. 1 shows a fixture for milling torque-bracket arms on a vertical miller. The work has to be milled on one face true with the turned surface around the boss. The bracket is turned to a gage for thickness so that the faces come out true when laid down and milled across. Nine pieces are placed in the fixture; the cutter is set by trial to the first one and the table traversed across. When the cutter has passed across a piece it is removed and another inserted. The only lost time is at the end when the cutter has to come back over the last two before they can be removed. The traverse of the table just covers the work. Stops are used in the fixture plate to prevent movement of the work. Adjustable wedges let into the plate, adjusted by means of screws, as shown in the illustration, support the work under the cut.

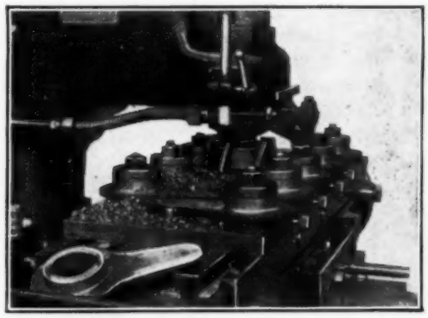


Fig. 1. Milling Torque Brackets

Fig. 2. Milling Brake Quadrants

V-shaped washers allow the work to be quickly removed from the studs, which fit the bore of the work. The cutter is of the inserted-blade type, 4¼ inches diameter with 6 high-speed steel blades. This kind is far better than the close-pitch cutter for most work.

In Fig. 2 is shown a fixture for milling brake quadrants. The work is milled and jig-drilled previous to this operation.

The fixture is a large drum on a mandrel with hardened centers. The flange of the drum is drilled at proper centers for pins which locate the work. Five sets of pins are fitted, each set holding 20 quadrants. A washer plate holds them together endwise. The flange of the arm is cut away to miss the cutter, one edge of this gap being used to set it. The fixture has stamped on it the number of divisions required to give the correct spacing of teeth. In the illustration it has two sets of pins loaded, this work being the last of a batch. It was necessary to pack up the drum to let it clear the table, as shown.

Fig. 3 illustrates a fixture for milling a slot in thrust blocks. The slot is 5/16 inch wide, ¾ inch deep and done at one cut; the work is a piece of ⅞ square, 1¼ inches long, case-hardened steel. Twelve pieces are placed in the fixture, a set pin in a swinging strap pushing them up against the end, while the clamps are screwed up.

The clamping device is an interesting feature, as it grips the work from two directions at the same time, with one screwing up. A long pin passing through lugs is the fulcrum, or pivot, for the clamps. On tightening up the loose jaw, the end of the screw presses against the work; directly this pressure comes on, the clamp swings down on the work and holds it.

A little clearance in the hole in the loose piece allows for any difference in the hight of the work. In the halftone one fixture is shown in position and the other dismantled to show the construction clearly. In use one jig is being loaded while the other is in work, thus keeping the operator busy.

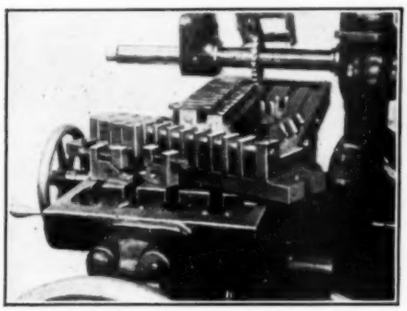


Fig. 3. Milling Thrust Blocks

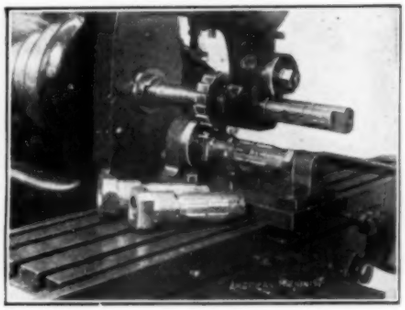


Fig. 4. Milling Couplings

Fig. 4 shows a fixture for milling couplings. It is in the form of an angle plate bored to receive a mandrel carrying a division plate with four holes. The angle plate has one hole bored and bushed to check up with the holes in the division plate. The mandrel is turned to suit the bore of the work and is hardened and ground. An outboard bearing is provided for steadying the arbor. The bracket is slotted so that it can be drawn away from the studs when removing the work. A nut on the end of the mandrel locks it. The work has to be square within a limit of 0.0018 inch, and the fixture produces parts to this degree of accuracy.

Weldless Steel Chains

At the October meeting of the Staffordshire Iron and Steel Institute, the paper presented was by Alex G. Strathern, on "The Manufacture of Weldless Steel Chains," and the following points from the paper may be of interest:

In the case of welded iron chains, the section of the material from which each link is made is uniform, and this in itself constitutes a defect. It means that if the ends of the links require to be of the section selected in order to sustain the load without undue stress to the material, then the sides are much heavier than what is actually required for strength. This waste material and excessive weight strikes one very forcibly when looking at a chain link which has been badly worn at the point where one link bears upon the other. Apart from the defect just mentioned, there is always the risk of a bad weld.

Another defect in an iron chain having an equal section of material throughout is that no allowance is made for wear, and if safety is to be considered an important feature, the load on the chain should be gradually reduced as the sectional area at the ends of the lines become less.

A number of years ago some interesting tests were carried out by the United States Board on the testing of steel and iron. These tests related to 210 lots of chain cables, and out of that number 107 chains had a strength of 55 per cent. to 70 per cent. of the double bar, while 65 of the chains had a strength of less than 55 per cent. of the double bar. This shows that for these cables, at any rate, it would scarcely be safe to consider the strength of the chain as more than equal to the single bar. It is usual to assume that from 20 per cent. to 40 per cent. is the loss of strength due to the weld. The average strength of the chain would therefore be 70 per cent. of the double bar, and the author considers that this is a very good average for a well made iron chain.

Early Developments in Weldless Chain

In the year 1853 the first patent on record, with reference to the manufacture of chains without welds, was granted to an American named Sleppy. The patent specification shows that the intention was to roll the chain from solid bars between four rollers having a wedge-shaped periphery, on which was cut the form of the chain links to be produced. Judging from the incomplete nature of the drawing and the lack of detail in the specification, it is assumed that this invention was never put into practice.

Strathern Process

Mr. Strathern passed in review a number of inventions, and then described a process he invented for the manufacture of weldless steel chains from cruciform bars in the year 1897. This process may be described as stamping or segmental rolling. A large quantity of weldless steel chain has been produced by a machine built in accordance with Mr. Strathern's patents; the machine being in operation at Gartsherrie, near Coatbridge. The machine is built almost entirely of cast and forged steel. Four crank shafts rotate in bearings at each corner of the main framing. These cranks transmit motion to slides which are arranged diagonally in suitable guides formed on the main frame; to the minor ends of these slides are pivoted the quadrants in which are secured the chain-forming dies. The arc which forms the faces of the dies is struck from a center which is somewhat to the forward side of the center line of the pivot on which the quadrants oscillate. The eccentricity thus produced has the effect of causing the dies to incline to rotate as soon as pressure is transmitted by the cranks. This combination of motion has the effect of feeding the bar automatically through the machine as the links are being formed. The cranks only move the dies in an inward and outward direction; the forward motion in the direction of the center line of the bar being obtained from the eccentricity of the dies. In order that the dies may press the bar evenly through their traverse, the rate of advance is controlled by a cam gear.

When the dies have returned to the starting point they are again pressed into the core of the bar by means of the cranks, and the same pressing operation is repeated. The movements described continue until the bar is stamped step by step throughout its entire length, which is usually from 55 to 65 feet.

The furnace employed for heating the bars is of the Weardale type, and is supplied by gas from a Dawson producer. After the bar, which Mr. Strathern says we may now call the "chain bar," leaves the pressing machine, it is allowed to cool in a long cast-iron trough or channel, which keeps it perfectly straight; the chain bar is then taken to a machine which punches away the webs or fins surrounding the inside and outside of the links.

The links are pressed separately in suitable dies, which make a smooth and uniform finish, any surplus metal thrown out by the action of these dies being cut away in stripping tools. Up to this stage the links are wider than the standard size, this extra width being necessary to permit of handling. They are afterward reduced in width in a machine having dies which completely surround each link and press it into the desired proportions. The chain is afterward carefully annealed, tested and examined.

These weldless steel chains are made in lengths which average about 60 feet. When longer chains are required these are connected by a special connecting link made from the finest quality of welding steel. Weldless steel chains made by this process are approximately 100 per cent. stronger than ordinary welded iron chains of the Admiralty standard.

The life of weldless steel chain is much increased by the thickened ends of the links, providing a greater bearing surface, and the increased area also prevents distortion of the chain under loads.

A Test Indicator

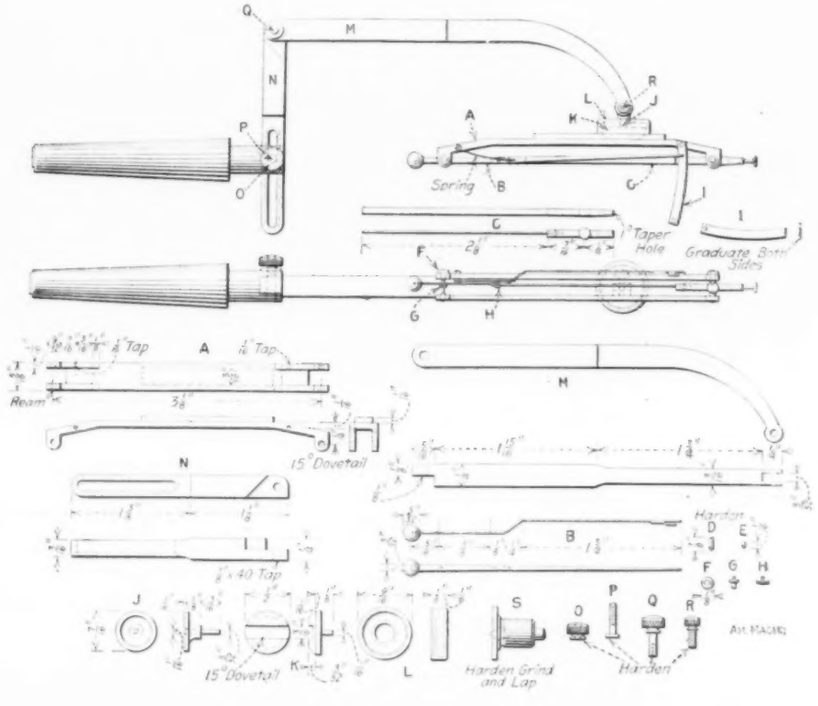
By A. Van Wagner

The indicator shown in the accompanying drawing is designed particularly for miller work, but its usefulness does not by any means end there, as a study of its features will show.

By omitting the taper shank it can be used in a drill chuck or universal chuck on any machine tool, and by drilling a hole in any piece of flat stock it can be used in any machine having a tool post. It can readily be clamped to any flat surface, such as an angle plate, straightedge, test parallel, surface gage, etc.

The uses it can be put to on the miller are numerous. Holes in jigs, buttons, etc., can be indicated very accurately, and the segment being graduated on both sides, the error in the work can be easily read in any position, as the indicator is revolved by the spindle.

By the use of the button and locating center, shown at *S* (which can be held against the face of the work by a little sealing wax), center-punch marks may be just as accurately set as a button, which, by the way, I think will be a new kink to a great many toolmakers, who have work of this character to do on the miller from a center-punch layout. For instance, in boring holes in a very large compound die, or in the punch, which, on account of its shape, could not be handily swung in the lathe, the holes could be bored in the shedder by setting buttons, and when finished could be used to locate the holes in the lower die or punch by the use of a locating center punch, ground to a close fit to the finished holes, similar to the one shown inserted in the bushing at *S*. The punch marks established, the piece may be mounted on the miller and indicated in the manner described above. The same method may be followed in working from a model,



A Test Indicator

master plate or templet, transferring to the side or cover of a jig.

The construction of the indicator needs but little explanation, although a few words as to some features may be necessary. Upon studying the drawing it will be noticed that a great many different positions of the indicator may be obtained by the use of the locking screws and nuts.

The two parts of the holder, *N* and *M*, may be adjusted to any desired position by means of the clamping screw *Q*, and the T-bolt and nurled nut *O* and *P*, which operate in the T-slot in *N*. The piece *N* can be moved out to the limit of the T-slot and then swiveled to a position parallel with the shank, thus increasing the length, as might be necessary to reach over a projection.

Part *M* may be disconnected at *Q*, which will adapt it to the bench-lathe tool post, the engine lathe, shaper, slotter, etc., it being clamped lightly to prevent springing.

Probably the best feature is the clamping device, which connects the indicator frame to the holder. The frame *A*, as is shown, has a dovetail slide integral with the back, which allows about 1 inch adjustment either way in the saddle piece *K*, which has a short bearing turned to fit the reamed hole in the disk *J*. The clamping ring *L*, which is threaded to fit the binding screw *R* being used to clamp it in any position required in this direction.

The swinging movement in both directions, as well as the parallel movement of the slide, makes it possible to test work in almost any required position.

The graduated segment has a screw hole in each end to enable the position to be reversed if needed to avoid obstructions.

Extra contact points to fit in the taper *C* can be quickly made to suit, as occasion requires.

Modifications in sizes or changes to suit individual or shop requirements can be made at the discretion of the toolmaker. I think that where accurate jig and fixture work is done on the miller, as well as close boring, testing, etc., on die and gage work, this indicator will be a valuable addition to the tool-room equipment.

Addition to Relieving Attachment

By K. H. Crumrine

I am sending with this two photographs of a device which we have applied to the relieving attachment of our Hendey-Norton lathe, which is used when relieving taps to render the cam inoperative when and handle with a pin to engage it as shown in Fig. 1. When the handle is down the cam operates as usual. When the handle is up the cam lever just clears the cam, so that the cam is entirely inoperative.

In starting a cut to relieve a tap, the lever of the device is dropped, the slow speed engaged, and the cut made. At the end of the cut the tool is withdrawn as usual, the handle of the device raised, the slow speed disengaged, the fast speed engaged, the tool quickly returned to the starting point, and the operation repeated.

Fig. 2 shows how we relieve left-hand taps. The view is from the rear of the lathe and shows the toolholder on the back side of the work.

The difference between this and the usual method of relieving right-hand taps is that the tool is upside down, in this case being bent, as there was not room enough to use a straight tool. The cut starts from the back of the land on the tap and finishes on the cutting edge.

In making molds for brass work, care must be taken to prevent the introduction of anything into the sand which will tend to coarsen it, and for this reason coarse parting sand is not suitable, hence many founders prefer to use a mixture of powdered rosin and charcoal

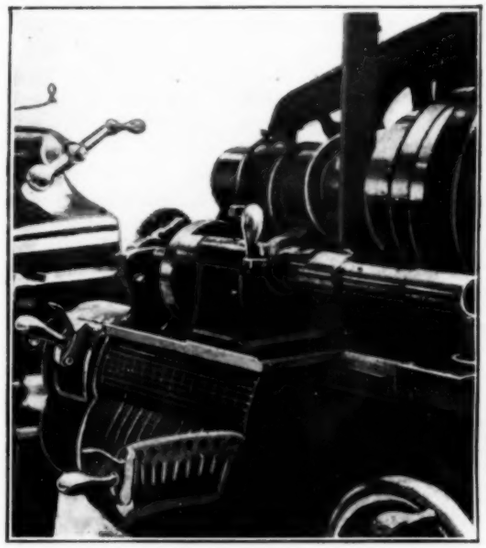


Fig. 1. Addition to a Relieving Attachment

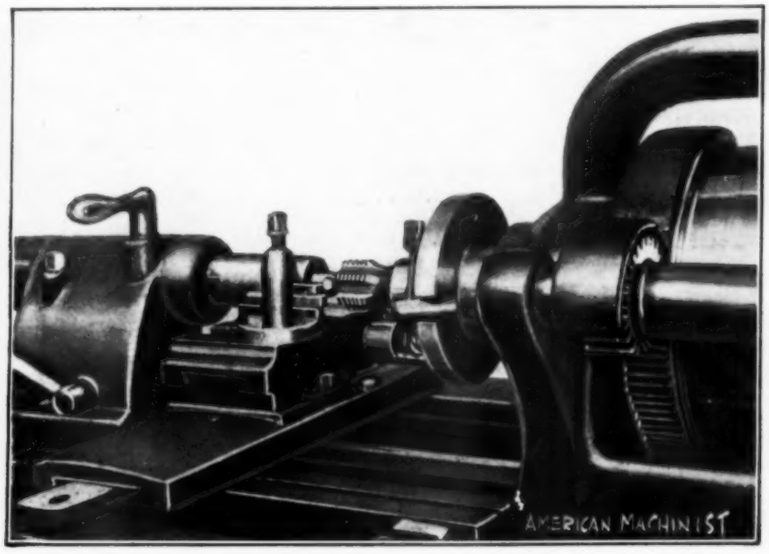


Fig. 2. Set Up to Relieve Left-hand Taps

K, binds the two together, thus allowing the device to swivel entirely around to any desired part of the circle.

The face of the ring nut *L* must be faced off until the distance inside is equal to the combined thickness of *J* and *K* when assembled. It will be seen then that it will not only lock both together, but will bear against the back of the dovetail slide, thus both movements are clamped in one turn of the ring nut.

The shank of disk *J*, which projects through the bore of the ring nut, is flatted off to fit in the slot in the holder *M*,

returning the tool from the finish of the cut to the starting point. This permits of a very fast speed during the return of tool without the usual clatter of the cam.

Those who are familiar with the Hendey relieving lathe know that it has a three-speed countershaft, one speed of which is intended for relieving. Connecting with this on our lineshaft we have a very small pulley (in our case four inches in diameter) which gives us the proper speed for relieving when the lathe belt is on a faster cone than usual.

The device consists of a clamp collar

or powdered charcoal, as parting. There are also special parting compounds which are furnished by the regular foundry-supply houses. For large or heavy brass or bronze castings the face of the mold is frequently prepared by sprinkling flour over it from a bag made of cheese cloth. Fine plumbago is then sprinkled over the flour and the surface finished with a small trowel or slick. In molding operations of this kind the foundryman should have a pair of bellows with which to blow away any excess of facing material.

Nontechnical Side of Machine Design*

By James Hartness†

Some of the points which one of our best known American designers has found to be helpful, if not absolutely essential to success.

The necessity for vital, personal interest, for consideration. of the user at every step, for allowing for human inertia and for looking at the question from all sides.

*Abstract of lecture before Stevens Engineering Society.

†President, Jones & Lamson Machine Company.

One of the first questions that arises in the mind of one who intends to undertake this work, is what constitutes natural fitness for it. There seems to be no positive basis on which to determine this in advance, but there are certain temperamental characteristics that undoubtedly have much to do with the success in this line.

The temperament should be one favorable to continuity of thought along a given line, and to this should be added one that by nature will take an intense interest in a subject. An absorbing interest is essential and may be developed by conforming to well known principles of orthodox psychology. Self torture or hard driving is not nearly as helpful as a strong inner purpose to keep the chosen subject in the real center of conscious thought.

The First Thing to Consider

When a problem of machine design is undertaken, the mind must make it the real center of attraction. To one having an average endowment for such work, this is not a difficult task, but to get the best results it should be rightly undertaken.

A chosen subject is brought to the center of attention by repeatedly bringing it into the mind at the moments of lull in the pressure of other affairs. The astronomers wait for the moment of best seeing, and the designer must wait for the actual psychological moment. The best seeing condition for the astronomer is due in a small measure to his own psysical condition, and in a large measure to atmospheric conditions, but the most opportune time for clear-headed vision of the designer is due mostly to his own physical and mental condition. Probably no two men have their minds equally affected by their environment or their physical condition, but the fact that there is a most favorable time and condition for such thought and work should continually be borne in mind.

This phase is mentioned in order to make clear, not only how a designer should work, but the thought that should be kept uppermost in the mind of one who is trying to do this work.

The physical condition is more or less dependent on the mood, or *vice versa*. The over-strenuous gait is seldom the best, and, of course, the extremely indifferent one is of little value. The best one for the average man is one born of a quiet environment, with mind and body in a fairly restful condition, or still better, in a rested and fresh condition. The quiet end of the day is almost as good as the early morning, especially if the day has not been over-strenuous and the activities have been gradually tapered off.

As already stated, the habit of thought most favorable for the persistence of a single group of ideas is attained by the practice of switching the attention back to the desired subject. This should be done at the opportune time; the subject should not be habitually forced on a tired mind; it should not be taken in as a painful study, but it should be made the one thing of interest.

Vital Interest Necessary

Another way of saying all this, is that the designer must get interested in the particular problem, and he must have one interest that crowds out all other thoughts, even to thoughts of similar work.

It is useless to say "get interested in the work," unless we suggest a way to awaken interest. Surely, we know that interest does not come at mere bidding, and that it cannot be forced by hard work. But it can be induced by an easy process in a normal being, providing he has not already too firmly established a set of habit thoughts of another kind. The normal being, by persistent intention, can establish the desired thought habits by returning the preferred group of ideas to mind.

Some designers have done excellent work with no thought of the psychological problems. But in this more strenuous age it seems best to take advantage of every aid to the desired end. But with the advance of the world of machinery there has been a better comprehension of the working of the "thinking machine," and we must take advantage of this knowledge in order to win out. It is particularly needful now to study its most efficient use. We are getting to the point when mental energy saving methods should be used.

The real secret of success is in establishing ruts of a useful kind, ruts with switches that may be operated by the mind at will, or that work automatically when the mind would otherwise wander. This may be called a lazy man's way of doing things, but it is the way to conserve the mental and physical energy, and it gets results. One easy way to build up this habit is to begin by displacing annoying thoughts with thoughts of work problems and after a time it becomes easy to cut out every other thought.

Elements to be Considered

In taking up the problems of design of a machine there will be found an almost endless number of elements to consider. The strictly mechanical problem of the best machine for the purpose never stands alone.

What is the measure of the best machine? How much can be spent on its design and construction? How much work is to be done? An endless variety of questions at once crowd into the mind for answer.

It is doubtful if all of the elements could ever be tabulated in any form that would be a positive guide in shaping the final result, but in a general way the designer should make a fairly good guess at the kind of standard toward which he should work.

There are, doubtless, men capable of carefully weighing the almost infinite number of variants, but such men usually lack the intuitive scheme of working, on which the inventive side of a machine designer depends. For the ordinary mortal the best process of working is to keep a vague picture of the whole requirement in mind while concentrating on some one phase.

If the inventive qualities are to be called into use, the economic side, the business side, the manufacturing, the selling, the personal profit in cash or glory, all these must be absolutely crowded out of the center of the mental picture. Even fleeting thoughts of other elements seem to prevent the inventive function of the mind.

In like manner, the problems of manufacturing, selling, patents, business organization, must each be given a separate consideration. The interval between taking up the various questions should be as wide as possible. The mind seems to require a previous notice of days or weeks or more in order to take up any one of these problems, at least, with any hope of success.

Designing by the Square Foot

The ordinary work of machine design, in which well known parts are grouped to accomplish a given end, without much thought of attaining anything approaching the best—such designing is like saw-

ing wood, so many square feet of paper should be covered per day, but the real higher type of work cannot be measured like cord wood, and such work requires the forethought, the close application, the keen interest, and the comfortable idea building.

The designing by the square foot is a good preparation, and many a good brain has been developed by such work.

The importance of designing a machine to meet all the conditions necessary to success from a mechanical and business standpoint is fully recognized by everyone, but the grouping of the ideas in the mind while working out the various phases must not be hampered by the bewildering picture of all of these problems, each demanding equal consideration at every move.

The phase in hand must have the concentrated attention and the best conditions for its solution. The harmonizing is an after process which must be worked out by a series of compromises after the various component elements have been almost independently considered.

Preventing Waste of Energy

In working out the mechanical schemes no energy should be wasted in trying to make the sketches correct in proportion. The very functioning of the brain along the draftsman's line shifts it away from the inventive mood. The exact drawing frequently shows the necessity of change in general scheme, but that is only one of the after steps. The fundamental idea is the starting point, and must be sketched out as fully as possible without losing the very frail thread of thought.

A clear view of the scheme is not to be obtained on demand. The schemer must wait in patience, as the astronomer waits for steady air, and like the astronomer, he must have every facility in shipshape.

Inventive schemes cannot be forced by strenuous effort. Such effort may result in slight refinements of a given type, but never would have invented the De-Laval or Tesla turbine.

It is not my purpose to belittle the great work that has been done in improving existing machines, for this, after all, is the real great work that must be done. It is the work to which the world owes its greatest debt for progress in material wealth. Furthermore, it is a phase that must be considered in connection with every invention before that invention can become of value to anyone.

The Knight of the Eraser

But just now we must consider *how* the inventor must work while dreaming out the fundamental ideas of a mechanical scheme.

The clear view of a mechanical scheme is more likely to come after a good night's rest, particularly if the schemer has retired with the problem in mind.

After this the inventor brings his dream to the drafting board, to patent office, to the factory and to the market, and in each place he encounters barriers.

The drafting board may show that no such arrangement of parts can ever be made, that the whole scheme must be altered to make it practical. A real hero is required for the work of juggling the elements on a drafting board. He must have patient endurance and sufficient strength of character to use the eraser heroically, for the eraser is mightier than the pencil in the drafting room. There are a thousand vigilant knights armed with pencils to one stalwart pusher of the eraser.

In the drafting room the work of harmonizing must go on; compromises must be made between the ideal scheme of the dreamer and the requirements of the manufacturing and selling departments.

The Toughened Idealist

Next to the noble knight of the eraser comes the idealist who has been toughened by experience in the cold world.

The idealist aims to design and construct a *perfect* machine. He is encouraged in his work by seeing a little clearer each day, month and year of the time spent in the right kind of application to his work. He knows that the work of last year is faulty, that this year's work seems nearly perfect, excepting for a certain slight change that has just entered his mind. He cannot think of allowing any machine to be made without this later improvement. He is inclined to the optimistic view, his memory works best on the good work of the past, and is exexceedingly poor in holding afresh the view of previous mistakes.

The toughened idealist may not look or act like an idealist, but in reality his idealism is one of the practically wise construction. He allows his memory to hold all that is helpful of the past, both of the blunders or successes.

The dreamer who has been toughened by experience is one who lets his rational brain have control. He ranks next to the stalwart knight of the eraser, because he has the courage to arrest the endless tinkering of design in order to get something done. He will not let the family freeze while he is thinking up some grand scheme for sawing and splitting wood by magic.

No Perfect Machines

A most cursory glance at the machinery in use in the world will show that the work has been done by imperfect machines.

A study of the design of any machine brings out the innumerable shortcomings. If we see a machine that seems perfect, it is perfectly safe to set it down in black and white that we do not fully comprehend it. It is safe to say that the only perfect machine is the new model that is to be tried very soon.

With these facts in mind, it does not require very much courage to go ahead with an imperfect design, but unfortunately these thoughts will not stay in the mind of the average mortal. They are crowded out by the flood of ideas for still further betterment, and that is why it is just to give high rank to the man who had courage to go ahead and build, even when he realized the faults of a designer.

Perhaps one of the aids to this action is the knowledge that the apparent opportunity to improve a design may only be apparent. In reality the change may be only a change, and no betterment. The knowledge of the great array of failures of such "improvements" is wholesome and helpful to bear in mind.

In designing the parts of a machine, the need of trimming here and there, of giving up this or that ideal form just to get things together, all this must be done unflinchingly. And in the same way the whole scheme must be made to conform to the economic conditions. If the machine under consideration is like a machine tool, and is to offered for sale, then the manufacturing, selling and use must be taken into account.

In machine-tool design a wholly new invention is an exceedingly rare thing, and a successful new machine is still more rare.

Human Inertia

It is barely possible that we could by patience, teach the robin to build a better nest than those now in fashion, but think of the time it would take! Think how the birds would worry while making these nests! Think of the mental culture we would have to bring to bear on the mother bird in order to get her within hailing distance of the nest!

In the same way we must remember our own tendency to follow precedent, and make an effort to see the problem in its natural form without being misled by the solutions evolved by others.

Designers strive to get out of the ruts of habit of design. They try to avoid making a railway carriage like a horse-drawn vehicle. They eliminate the unnecessary elements of previous designs. They try to make the best piece of mechanism for the purpose under consideration, and if they are wholly successful in this respect, they may after all be doomed to disappointment if they have failed to take into consideration the robin-like characteristics of others. It is one thing for an inventor to get himself out of a rut, and still another to get others out.

When the designer is trying to make the most natural machine for the purpose, he must overcome his own tendency to follow precedent; and when considering the kind of a machine that can be easily made, sold and used, he must give due consideration to the inertia of others, for their inertia he cannot hope to quickly change.

We Must Consider the Other Fellow

Reformers in this world generally have a hard time whenever they underestimate the inertia of habit of mind and body. But whether the clear view of the designer is due to peculiar fitness for seeing such things, or to proper application, the fact remains that this clear view of the technical side is insufficient in itself. For it must also see that others do not get the same view. He must know that the mind automatically takes in things of interest to it and wards off others.

This failure of mankind in general to grasp the advantages of a new mechanism as it appears on paper is only a slight part of the troubles to be encountered by a progressive designer. He has the robin-like characteristics of all of the human beings affected by the new machine. This includes the entire group of men in the manufacturing plant in which the machine must be made, the business organization both in this plant and the one in which it is to be used, and after all this, the greatest obstacle is to be met in the robin-like characteristic of the one who uses the machine. It is in the hands of the users that a machine must prove its value.

When we consider the inertia of mind and body, it is truly marvelous that there has been any progress in machine design. In fact, if the machine-building trade were in retrogression with only a few men being taken in there would be little or no excuse for making machine tools of new design. The older workers would get along about as well without the improved machines. This is not said in a spirit of fault finding. It is a great fact that we should grasp if we are to design machinery successfully.

Accepting this view is no barrier to progress. It will not ultimately delay the work of a reformer if he is induced to act in accordance with this principle. It only prevents a wreck.

Economic Success

Inventions of complete novelty and of great economic value have attained success going in opposition to this principle of conformity to the habit of the world, but the easiest way is to direct improvements and inventions along lines that are the most readily assimilated by the minds of those to be considered, and this may be said to be one of the master keys to economic success.

The work of building the first model of a new machine may be under the direct supervision of the inventor, and if only one machine is to be made the inventor can follow it wherever it is to be used, and by patience and industry he may instruct some one in the use of it, but in these days there is no chance for a great economic success in making just one machine, or in fact any machine for which there is not a large market; hence, we will confine our attention to machines made in such large quantities that the complete supervision of manufacture, sale and use is beyond the capacity of one person.

In all such machinery the design must more or less conform to the thought and habits of work of all concerned. Some of the most direct designs have failed to meet with success, just because the inventor did things in an unusual way.

Radical Change Incur Opposition

If a radical change in design is to be made, the new machine should be one that will be the most readily understood. Obscure parts or unusual means should be avoided. If moving parts must be covered, some way should be provided for convenient observation. It is the obscure departure that is most troublesome, and it is the obvious thing that offers the least resistance to progress.

The favorable features in machine design are: Directness of mechanism for the purpose—its simplicity and its efficiency—its adaptability to the habit of thought and action of makers and users. The obstacles to its success are any features it may have that are not readily comprehended by those to build, sell buy and use these devices. It is of little value for real success for a machine to be one that is readily understood by the draftsman or manager, or that it is one that may be made to perform wonders in the hands of a skilled expert.

The real economic success depends on the number of machines that will be used. The number of machines that will be used depends on the readiness with which the real workers take hold and manipulate the machine.

The Operator Must Be Considered

If a machine is one that is to be operated by a human being, it must be built to conform not only to habits of mind and body, but also to his mental and physical makeup. The man who remarked, while standing in line waiting at a box office, that he would rather walk ten miles than stand five, expressed an important fact that we should keep in mind in designing machines. The human being must neither be unduly restricted in his freedom of action nor overtaxed with hard work. If the use of the machine induces either an adverse mental attitude or physical condition of the worker, it will sooner or later be adverse to the economic success of the machine.

A keen observer of men and machinery may not require as much of the so called practical experience; another may need many years of actual work. The practical experience in the various departments of machine construction, its sale and its use, is undoubtedly almost absolutely necessary for the average man in this work

Its value is primarily to give an opportunity to see things in actual operation. In the works an opportunity is afforded to see how a machine stands up to its work, where it is weak, and a thousand and one other points that can best be seen in actual operating. But there is still another phase that is comprehended more readily by the practical experience, and this applies to the various departments of business as well as to the works:

Understanding Human Nature

A keen observer soon realizes that successful life in the machinery world will not come easily to anyone who lacks a good understanding of others in the field.

One of the first things we learn in the works or office is that all men are really human beings. The second is that the meanest one is only so because of certain physical or mental conditions that are the direct result of natural law, and usually it is not necessary to drag in hereditary causes, for we find ample causes in his direct environment.

As a rule, a good understanding of men insures a wholesome regard, and a failure to understand the other fellow, or the equivalent, the failure of the other fellow to understand us, may bring out many things that make us feel that he is not one whose feelings or interests should be considered.

To anyone who has had a shop experience and a fairly well rounded business and financial experience in this particular field of work, the other fellow is invariably a good fellow whenever there is a chance for a fairly complete understanding.

The machine builder knows that the success of any machine depends on the clear sightedness of his designer and the oneness of purpose of all the heads of all the departments devoted to the construction, sale and oversight of the running machines in the hands of the users. And last, but not least, in these days of supremacy of specialization, he knows that success comes only to the largest group of men organized for this particular kind of work.

Success Must Be Worked For

This group may be a separate organization, operating as a separate company, or it may be a part of a large organization devoted to a variety of purposes, but if it is a part of a large organization, it must have an absolutely independent organization with the free management of business, and it must be unhampered in the control of its construction, sale and direction of its use. The men engaged in production or in the business or the operation should have no other work, and, as already stated, this group of men should be larger than any other group devoted to a competing machine.

Workmen must not be changed from one class of work to another, excepting

for promotion, and business men should not be expected to know all about two or three machines of unlike characteristics.

Improvements should be sparingly made. Any improvement that requires a change in construction or operation may be disastrous financially.

This may all seem extremely pessimistic. Perhaps it is. But it seems warranted by experience. Surely it seems to be the true view.

And if it is true, then the machine designer should know it. A mere knowledge of mechanism is insufficient for him. A large business experience cannot be purchased. His success should not be contingent on the business ability of another. He should know how a machine should be designed, and should not depend too heavily on the views of the business men who have not a clear knowledge of the technical problem.

A Record Cost Card; a Few Reminiscences and a Word about Piecework

By W. S. Morehouse

So many articles have been written on cost keeping that one is now apt to pass them wearily by with only a glance at the title. I am not a close reader of the trade papers, and, doubtless, valuable ideas on this subject have appeared, in these and other columns, that have escaped my notice. However, in the multiplicity of forms that I have seen, a card for recording the time and cost on separate operations, or on a succession of operations performed at one setting up of a machine and constituting a unit operation as far as cost keeping is concerned, has not been so presented as to make a lasting impression upon me.

The time and cost record card illustrated herewith was evolved by myself and associates as part of a homemade cost-keeping system which grew up with and which was an essential part of our work of modernizing a plant devoted almost wholly to the production of, let us say for illustration, direct-acting steam pumps.

To be sure, it was only a bit of a place with not over 100 men in the machine shop, but we were prudent with our expenditures and studiously avoided "red tape."

The prodigious amount of work required to modernize a shop that has grown old comfortably and that has unconsciously become obsolete in its methods and equipment, because the unusual merit of its product has held out so long against all aggressors, is scarcely comprehendable to one who has not been through with it. There are real obstacles a plenty and then, too, the sentiment of the good old days! How pleasant and prosperous were the good old times! One foreman was enough for a shop full of men! Just give the boys the castings and they knew what to do with them! The old notched sticks and the jealously guarded personal note books made the old hands disdainful of blueprints. And how capable those old hands! To run three or four lathes at a time was no great stunt.

Real modernizing means starting at the bottom. It demands time, energy and money. To have shop blueprints that are worth anything means to have a drafting room that can dig up the facts from the shop. To have tools, jigs and fixtures of real worth (and avoid ruinous cost) means to have a tool-room organization seasoned for the business. To get a day's work for a day's wage requires more than naked machine tools, however modern they may be.

The home of this particular record time and cost card is in the manufacturing machine shop where parts and machines are produced in lots, whether large or small, and where odd or special machines are built occasionally; some kinds being produced frequently, others only a few times per year.

Turning now to an explanation of the card. "Ck"9 at the top of the second column means the workman's check number. All other details will be readily understood. The card shown is not the original for the jobs indicated and it does not show all the lots that were produced from November 28, 1903, to June 3, 1905, having been abbreviated for convenience of illustrating the history of the changes during that period for one job.

The original and complete card, or set of cards, shows the total number of one size of steam-chest plungers that had been turned and faced during the period. Later, this record of output was found useful in fixing quantities for the store room to order by and the stock to carry. But the most valuable items are the average time and cost per piece, with explanations under "Remarks."

Time and again, these cards have made daylight shine in the dark places of the shop, both before and after piecework was established. For instance, a new man would be put on a job and the time on it would go up without being noticed by the foreman. Many an incompetent man was fired when the facts were shown up by these records. It is all very well to expect the foreman to know just what is what and keep everybody up to the mark, but in real shop life such men don't stay foremen for long.

Piecework

When it came to starting in on piece work, these cards furnished much valuable information, but they were not allowed to more than suggest a piece. It had been my intention to introduce the premium plan, because piecework as observed and used in other places had shown a very unattractive side; then one of my associates remarked that piecework has merit and this led to a careful review of the whole subject and we decided that piecework would be best for our conditions. And this is how we went about it. A few jobs that had been in the hands of a good sensible man were investigated first. The cost card showed the record of quantities, times, and costs, and the machine and tools used, for several months back. This was the first step. The next, and by far the most important of all things connected with fixing piece rates, was a thorough investigation by estimating, or by actual trial of the facilities by an expert, or by both, and then the determination of what was a good big output by a good average workman and a plain price per piece that would enable him to comfortably earn about one-third extra pay.

Then we said to the man: "Try out this job, if you care to, at the price per piece; we want and expect you to earn more than by day work; anyhow you will have your regular day's pay if you can't earn

COST CARD

Size No. 5
Dimensions
Type
Part Steam Chest Plunger
Operation Turn and face

Drawing Number 5053
Pattern Mark S 5
Weight 16 Pounds
Material Cast iron
Time Limit
Contract No. 107

Date	Ck. and Day Rate per Hour	Machine No.	Number of Hours	Amount	Number of Pieces	Average Cost per Piece	Contract Price per Piece	Average Time per Piece	Piece Work Wage Rate per Hour	Remarks
November 28, 1903	63–27½c.		33½	39.11	20	45½c.		100		Old machine
April 7, 1904	9–18½c.		11	2.04	14	14.6c.		47		Old machine
July 7, 1904	51–25c.	39	10	4.44	37		12c.	16½	44.4c.	New machine
October 8, 1904	51–25c.	39	5	2.32	29		8c.	10	47.8c.	New machine and some new tools
June 3, 1905	116–30c.	39	2¾	1.08	18		6c.	7½	43.0c.	New machine and new tools

more, so do not worry about that; if you make good, the price stands until the rigging is improved or until there is some other good reason for changing it other than the wages you may make on it." So piecework started all right. However, we used the term "contract" and, in fact, a formal contract was made out for every job and every time it came around.

It was not long before there were requests for "contracts" from all over the shop. And how it did jump up the output and swell the pay envelops! There was never any trouble about it. The standard of workmanship was easily maintained by the inspectors. The men were all industrious on their work and all well satisfied. It was a good thing for all concerned. I could go among the men and meet them on a fair and square business basis, always mutually frank, open and above board. It is a mighty satisfactory way to run a shop.

The Chance for Sugar Machinery in Cuba

There is little doubt as to the growing field for sugar-mill machinery of all kinds in Cuba and it remains to be seen whether American manufacturers will make the necessary efforts to secure the business. The preferential duty which the United States enjoys in most cases, does not apply to sugar machinery, so that all nations are on an even footing.

There seems to be no reason why American manufacturers should not secure a fair share of the business, or even more, but they are evidently not doing so at present, for two reasons, according to Americans in the sugar business in Cuba.

These are the unwillingness to do business on the terms which are usual among the sugar-mill men and the lack of attention in laying out, designing and building the machinery.

The sugar planter or mill man never expects to pay for machinery of any kind until the next good crop is harvested and paid for. This means that credit may extend from three months to as many years, with an average of a year, according to machinery dealers in Cuba.

With the advent of a good crop, all bills are paid, the planter takes his family to Europe and money flows like water because he is a good spender. Should the next crop be poor, bills for machinery are very apt to be overlooked until the following year. No one likes these conditions, unless it be the planters, but it is not an easy custom to change without concerted action. And this may be even harder to secure owing to the different nationalities involved.

If these conditions do not scare the maker of engines or machinery, he must next consider quality and convenience.

According to an American who is now erecting a mill in the interior, our manufacturers do not pay enough attention to details; are not careful enough about the little things. Too much is left to the erecting engineer to fit up when he sets up the machinery. Pipe connections do not fit and have to be spliced or cut. He says:

"Now take the French and German builders. Every piece goes into place and fits. If I need a new piece next year, I send them the number from the blueprint they supply and they send it to me —and that fits too. I'd like to try American machinery but until they give as good service as the Europeans I'll buy the best, even if it costs more."

And this was a spot cash job too.

Table of Brinell Hardness Numerals

The accompanying table of Brinell hardness numerals has recently been made available in wall-poster form for distribution to those interested by the Souther Engineering Company, Hartford, Conn.

Brass Alloys

Strictly, a brass is a copper-zinc alloy containing one-third zinc and two-thirds copper; whereas a bronze is a copper-tin alloy containing approximately 10 per cent. tin and 90 per cent. copper. The old-style gun metal contained from 90 to 92 per cent. copper and from 8 to 10 per cent. tin. Lead is frequently added to both these classes of alloy to make them machine more easily, and both tin and zinc are commonly used in the same alloy, so that today we have a series of copper-tin-zinc alloys of almost infinite variety. In all cases in the useful alloys of this class, however, there is present more than 50 per cent. copper.

In most of the modern alloys tin is depended upon to give strength and zinc to cheapen the mixture. Some of the old-style gun metals contained as much as 16 per cent. tin and 84 per cent. copper, but such metals were brittle and hard. The common yellow brass employed by plumbers in making ordinary valves and fittings may be considered as composed of approximately 16 pounds copper, 8 pounds zinc, and ½ pound lead. It will be noticed that this consists of approximately one-third zinc and two-thirds copper, with a little lead added to improve the machining qualities. For the making of high-grade casting ingots or new metal should be used in all cases. In making a brass the copper should be melted first and the zinc added, care being taken not to let the temperature rise too high, for if it does the zinc will ignite and burn. The lead is added last and the metal thoroughly stirred.

In a copper-zinc alloy or what is commonly known as a brass or yellow metal, all the constituents are soft and the alloy is more or less malleable until more than 35 per cent. of zinc is present; beyond this point a hard constituent or compound appears in the alloy, so that it is no longer suitable for bearing purposes.

Diameter of Impression, Millimeters	Hardness Numeral Pressure, Kilograms		Diameter of Impression, Millimeters	Hardness Numeral Pressure, Kilograms		Diameter of Impression, Millimeters	Hardness Numeral Pressure, Kilograms		Diameter of Impression, Millimeters	Hardness Numeral Pressure, Kilograms		Diameter of Impression, Millimeters	Hardness Numeral Pressure, Kilograms	
	3000	500		3000	500		3000	500		3000	500		3000	500
2.0	946	158	3.0	418	70	4.0	228	38.0	5.0	143	23.8	6.0	95.0	15.9
2.05	898	150	3.05	402	67	4.05	223	37.0	5.05	140	23.3	6.05	94.0	15.6
2.10	857	143	3.10	387	65	4.10	217	36.0	5.10	137	22.8	6.10	92.0	15.3
2.15	817	136	3.15	375	63	4.15	212	35.0	5.15	134	22.3	6.15	90.0	15.1
2.20	782	130	3.20	364	61	4.20	207	34.5	5.20	131	21.8	6.20	89.0	14.8
2.25	744	124	3.25	351	59	4.25	202	33.6	5.25	128	21.5	6.25	87.0	14.5
2.30	713	119	3.30	340	57	4.30	196	32.6	5.30	126	21.0	6.30	86.0	14.3
2.35	683	114	3.35	332	55	4.35	192	32.0	5.35	124	20.6	6.35	84.0	14.0
2.40	652	109	3.40	321	54	4.40	187	31.2	5.40	121	20.1	6.40	82.0	13.8
2.45	627	105	3.45	311	52	4.45	183	30.4	5.45	118	19.7	6.45	81.0	13.5
2.50	600	100	3.50	302	50	4.50	179	29.7	5.50	116	19.3	6.50	80.0	13.3
2.55	578	96	3.55	293	49	4.55	174	29.1	5.55	114	19.0	6.55	79.0	13.1
2.60	555	93	3.60	286	48	4.60	170	28.4	5.60	112	18.6	6.60	77.0	12.8
2.65	532	89	3.65	277	46	4.65	166	27.8	5.65	109	18.2	6.65	76.0	12.6
2.70	512	86	3.70	269	45	4.70	163	27.2	5.70	107	17.8	6.70	74.0	12.4
2.75	495	83	3.75	262	44	4.75	159	26.5	5.75	105	17.5	6.75	73.0	12.2
2.80	477	80	3.80	255	43	4.80	156	25.9	5.80	103	17.2	6.80	71.5	11.9
2.85	460	77	3.85	248	41	4.85	153	25.4	5.85	101	16.9	6.85	70.0	11.7
2.90	444	74	3.90	241	40	4.90	149	24.9	5.90	99	16.6	6.90	69.0	11.5
2.95	430	72	3.95	235	39	4.95	146	24.4	5.95	97	16.2	6.95	68.0	11.3

TABLE OF BRINELL HARDNESS NUMERALS

STEEL BALL OF 10 MILLIMETERS DIAMETER

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Draw-in Chuck for the Grinder

An order came through our shop recently, to make 60 round combination punches and 60 dies for our large gang presses, each press being equipped with 15 dies for punching and forming light metal shells, etc.

The blanking and drawing punch was a simple bushing 3¼ inches long, 1 7/16 diameter outside, and 1 3/16 diameter inside, the die being 2 inches long, 1 1/8 outside diameter and 1.439 inside. Both punches and dies had to be hardened and ground all over; also they must be interchangeable in all dimensions within 0.005.

As we had no special equipment for this class of work it was up to me to think up a way to get them out. Time was of extreme importance, also the cost had to be kept down as low as possible.

The sketches show how it was done. Patterns and castings were procured for the parts *A* and *B* of a simple draw-in chuck fixture designed to fit the head of the Bath universal grinder.

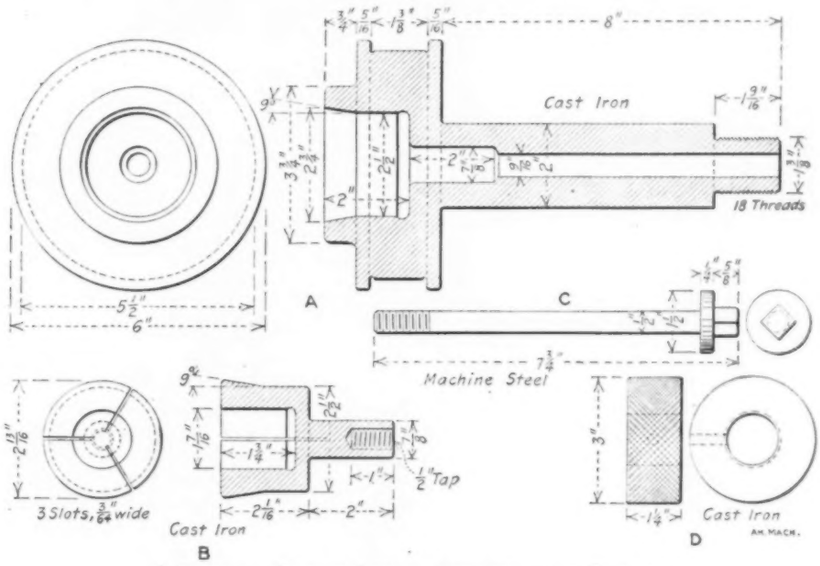
Part *A* was machined all over, a few thousandths being left on the inside and on the angle, which was afterward finished in place on the grinder with the internal grinding fixture. This being carefully done gave a good true job.

The chucks like *B* were also machined all over, with stock left inside for finishing by grinding. The slots being milled, etc., 3/64-inch strips of metal were slipped in the front of the slots, then the chuck was placed in the fixture and drawn home with the draw in bolt *C*. The chucks were then ground out true and to size.

In the meantime the punches and dies had been roughed out, hardened and drawn in the oil tempering bath, then rough ground all over to remove strains, and finished in the fixture mentioned. The job was finished on time, with the necessary accuracy and showing a considerable saving of time above that expected.

The fixture cost little to make and saved its cost on this job alone. Chucks of various dimensions to suit work within the capacity of the fixture can be made up cheaply and added to the equipment of the machine, greatly adding to its usefulness on small work wanted in a hurry. A great number of uses will suggest themselves to any good mechanic in this connection and much small round work now finished in the lathe can be done on the grinder, showing a gain both in speed and quality.

Brookyln, N. Y. H. T. STOKES.



A DRAW-IN CHUCK ATTACHMENT FOR THE GRINDER

Fixture for Drilling Automobile Brake Clevises

In the accompanying illustration is shown an interesting fixture for drilling and tapping automobile clevises. These clevises are made of tough steel, drop forged and very light. In this operation care must be taken to get them properly centralized in the fixture.

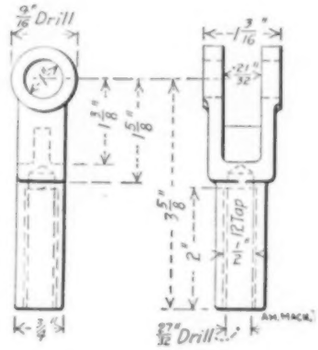


FIG. 1. PROPORTION OF AUTO BRAKE CLEVIS

Fig. 1 shows the clevis to be drilled and gives an idea of what this piece is, as dimensions are given. Fig. 2 depicts the fixture. The body *A* of this fixture is machined from a bar of steel, one end being tapped to receive the adjustable drill bushing *B* for drilling out the boss end of the clevis. The end plates *C D E* form an opening for inserting the clevis *E*, being hinged to *C* and held in *D* by the pin *F*. The plate *E* has two grooves *G* for locating the clevis end of the forging; the plate *H* locates the pin hole in this end of the piece. The body *A* also has a slot

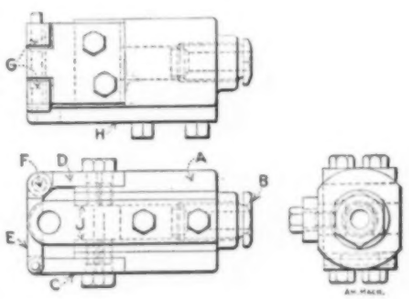


FIG. 2. FIXTURE FOR MACHINING AUTO CLEVIS

J, against which the clevis is held; in this way the work is held rigidly. The bushing *B* centralizes the boss end, thereby taking care of the variations in the forgings. There is no machine work excepting the drilling, tapping and milling of the clevis end. Two bushings *B* are used, one for drilling and one for tapping.

In removing and replacing the clevis in the fixture it is only necessary to back out the bushing *B* about two turns, then remove the pin *F*, insert another forging, replace the pin *F*, and tighten the bushing *B*. It will be noted that the body is milled out to receive the plates *C D*, so as to make them rigid and not permit the clevis to spring in the fixture. The fixture is of such proportion as to allow of being readily clamped to the machine table.

St. Louis, Mo. C. T. SHAEFER.

An Indexing Drill Jig

The accompanying cut shows a drilling jig which may be of interest to readers of the AMERICAN MACHINIST. There were 36 cast-iron wheels, 40 inches in diameter, 5 inches bore and 8 inches through the hub, to be bored, keyseated,

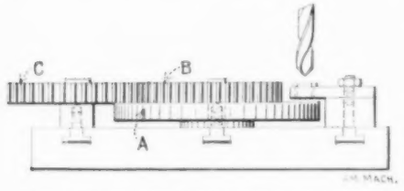


FIG. 1. JIG FOR DRILLING THE INDEX PLATE

and to have seventy-two ¾-inch tapped holes, equally spaced around the rim, drilled at an angle and 2½ inches deep.

All the parts used in making the jig

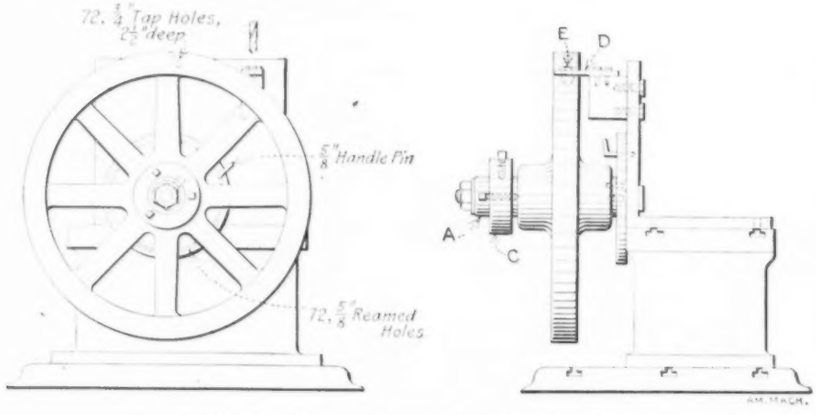


FIG. 2. JIG FOR DRILLING THE RIMS OF THE WHEELS

were picked up around the shop and the index plate was made by mounting a disk as shown at *A*, Fig. 1, on the drill table, using a 72-tooth gear *B* and an idler *C*, locking the gears with a ¼-inch piece of cold-rolled steel, drilling and reaming a hole then turning to the next tooth, and so on, as we had no dividing head in the shop. This plate was counterbored and the bushing *A*, Fig. 2, fastened to it with three countersunk screws as shown.

As the hubs were not faced on either end, three tool-steel pointed screws were used in the plate and the collar *C*, and to compensate for any difference in the length of the hubs on the wheels, the top plate *D* was slotted so that the drill bushing *E* could be brought in line with the middle of the rim.

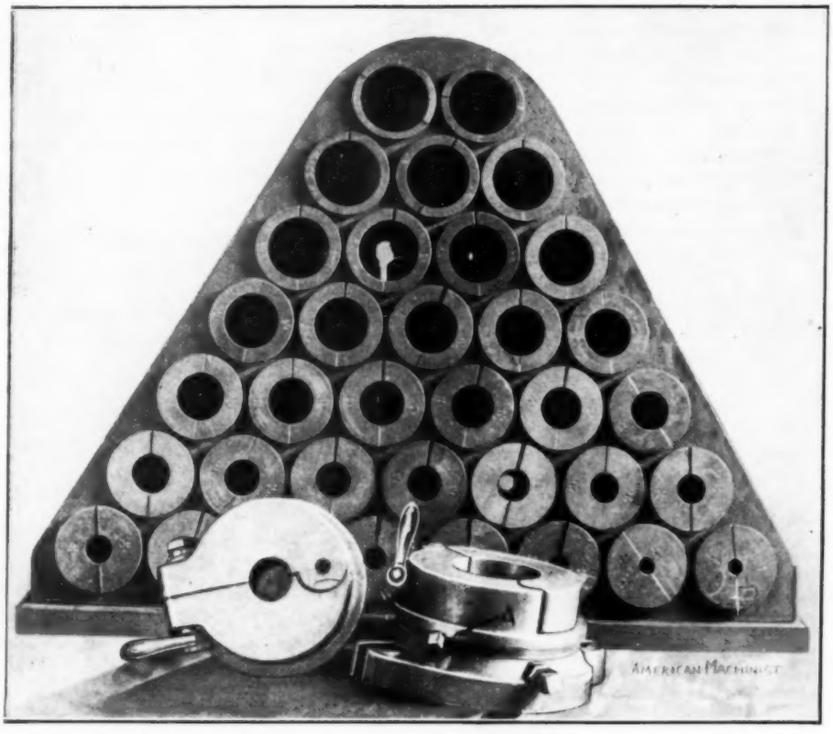
We used a high-speed drill, drilling all the holes in one wheel first, then tapping, using a friction tapping chuck. The keyways were scribed from lines on the bushings before moving the wheel. These wheels were drilled and tapped at the rate of three a day without the least trouble. CHARLES ABLETT.

Pittsburg, Penn.

Vertical Milling Vise for Cylindrical Work

The halftone shows two fixtures in use in the shops of the Waterbury Farrel Foundry and Machine Company, Waterbury, Conn.

There are two sets of bushings, one of which is shown in its stand at the back. Cylindrical work from ¼ to 2¾ inches in diameter can be held in the two



VERTICAL MILLING JIGS AND BUSHINGS FOR CYLINDRICAL WORK

fixtures shown. The clamping member, bushings and work can be rotated and secured at any point by the setscrew *A*. The bases are graduated to facilitate angular spacing.

New York. E. A. DIXIE.

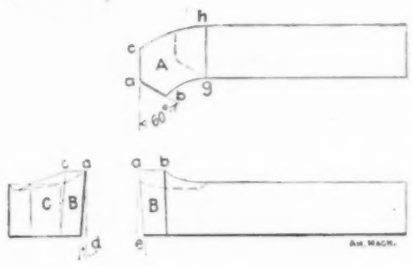
Particular attention should be given to the storage, preparation and mixing of core sands. The sand should be put into storage at the time of year when it is dryest, as this saves freight and also insures sand in better condition for core work. Core sand should always be kept under shelter. The method of storing sand will depend largely upon the size of the plant. For comparatively small plants a series of covered bins may be arranged in the basement and the sand introduced into them through chutes in the side of the building from a switch outside or dumped into them through hatches in the roof. For the storage of large quantities of sand, concrete bins are best.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Lathe Tools

I was interested in the general-purpose lathe tool adopted by the Lodge & Shipley Machine Tool Company, described by H. M. Wood on page 463. The body of the tool beneath the cutting point has been rounded off, so that the point of effective support is placed further back than it need be. Also there is insufficient metal behind the cutting point which should not be so round. The tool does not appear to be particularly easy to forge or to grind.



LATHE TOOLS

The cutting tool shown in the sketch appears to me preferable in many ways. The business end consists of three flat or nearly flat faces *A* (top) *B* (cutting) *C* (following) of which *B* and *C* are joined up by a curve of 10 radius. The faces *B* and *C* are easily ground by holding the body of the tool flat on the grindstone table, and pressing the end against the stone. The curvature of the rim of the stone (unless it is very small) will give the necessary clearances *d* and *e* (about 5 degrees). The face *C* should be parallel to the direction of motion of the carriage, and the face *B* at about 60 degrees to it. The top edge of face *B*, which does the cutting, should be horizontal, or nearly so. Looking at the plan view it seems as if the top edge *d c* of face *C* would rub on the work, but the angle of face *A*, usually known as the "top rake," prevents this.

The face *A* requires careful grinding; it should slope down in a direction at right angles to *a b* so that its lowest point is *h* and the points *g* and *c* are at equal hights from the bottom of the tool. As this tool may be supported right under the cutting edge, it is not unduly weakened by continuing the face *A* well back, which insures rapid removal of the hot chips. It should be ground chiefly on the top face *A* to preserve the form, but the faces *B* and *C* may be gradually taken back. If they are ground too often the tool assumes the form indicated by the dotted lines, in the plan view, in which everything is crowded and the cutting edge is in an awkward position. The point *A* should always lie just over the outside edge of the tool holder and should not be allowed to move inward with grinding.

The inclination of the faces *B* and *C* should remain about the same for all materials, but the top rake should vary from 10 degrees for very tough steel to 40 degrees for cast iron. I cannot understand why Mr. Wood grinds his tools with blunter angles for cast iron than for steel.

With a top rake of 30 or 40 degrees, and a coarse traverse, cast iron should peel off in spiral turnings ten inches long.

This tool is very simple to forge and to keep in condition. If made of high-speed steel (as it should be) it is a good tip to remove very keen edges by gently rubbing them on a piece of mild steel, so that they are imperceptibly rounded. This prevents the edge crumbling and makes no difference to the cut.

R. O. HERFORD.

Manchester, England.

Cast Iron Bearings

On page 368, there appears an article by Walter Clarke, who asks about cast-iron bearings on the connecting rods of high-speed gas engines. I presume he refers to automobile engines and the like. I have spent a great many happy and unhappy hours building engines of this kind, long stroke and short stroke, large bore and small bore and have used cast iron on some of these in both the piston-pin end and the crank-pin end.

In the piston-pin end cast iron is a good deal better than bronze if made thick enough to prevent crushing. Mine were ¼ to ⅜ inch and mostly made of sash-weight castings, some of which were pretty hard and others rather soft. The pins were almost all 1 inch or 1⅛ inches diameter, soft and of Shelby tubing; the length was from 1¾ to 2¼ inches. The bushings were sometimes made a tight fit in the rod and reamed and sometimes simply bored. The crank-pin ends were designed for these cast-iron "brasses" and in every case worked as well as other material. While I used no special method to fit them I was careful to get as smooth a bore as possible with a lathe tool, and then a little scraping to remove the loose iron finished the job, not forgetting oil holes and some oil grooves on the bottom half.

In one case I tried to replace the brass shells with cast iron but found them broken after having them in use about two months. This was a two-cylinder automobile engine, vertical and of a high compression. As new connecting rods would have been required in order to use cast iron, bronze was again used. I have found cast iron almost equal to hardened tool steel, and in every case where I have used it in the building of new machines this material was satisfactory.

I have just put into operation a grinder used in the manufacture of calipers; the wheel spindle is 1⅜ inches diameter and runs in a bearing 7 inches long. Both spindle and bushing were lapped and are a very close fit, as is necessary on a machine tool of this kind. Although this machine has not run a great while, I find on close inspection that nothing has happened which would change my faith in cast iron for bearings, and in fact I never gave this a thought when making the drawing for this tool. The cast-iron habit grew with me, as when a boy mechanic I found the little pocket money would not buy many brass castings, while scrap iron was cheap; hence by necessity I was forced to use cast iron where others would not think of doing so.

In closing I wish to add that the cast-iron connecting rod ends were so made as to have no narrow rims projecting as is usually done in the marine type of rod but were made rather massive; all corners had a liberal fillet.

Milwaukee, Wis. A. J. MACHEK.

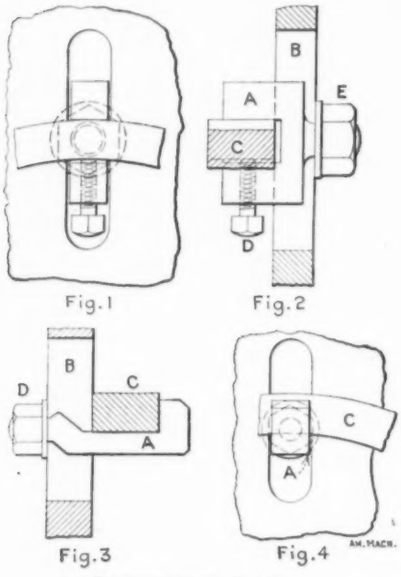
Piston Ring Clamps

I have noticed several articles in the AMERICAN MACHINIST on the making of piston rings in large quantities. But how about the repair man who has to replace one or two rings?

Did you ever cut one off and find it a little over or under size, or discover that the parting tool or side tool had worked bad and the ring was heavier at the bottom by a couple of thousandths of an inch than it should be? Or after splitting it have you had to hunt for a couple of hours for a suitable clamp to hold it

while turning to size? I have had these troubles and have found that the ring clamps illustrated by the accompanying drawings will overcome them and do for all kinds and sizes of rings.

Figs. 1 and 2 show the clamp *A* for facing the ring. It is fastened to the ring



PISTON-RING CLAMPS

C, then passed through the faceplate *B* of the lathe and tightened by a nut *E*. The rest of the clamps can then be slipped through the faceplate and fastened to the ring. All is now ready for facing. The clamps should be designed to suit the faceplate slots.

I use a set of four and have faced rings of 2 feet in diameter. Figs. 3 and 4 are of a clamp for turning the ring to the required diameter. Close the ring by a soft wire and pliers, letting the wire pull the ends together. Don't shove it by hand as it strains the ring and its outline will not be symmetrical. The clamp that is placed over the lap can have a reinforced bearing surface by placing a strip of ¼-inch steel between clamping surfaces.

Brooklyn, N. Y. CHARLES SEILER.

Roll Grinding by Old and New Methods

Referring to Mr. Conradson's article on page 559 in reply to a former one of mine, and quoting "Mr. Nevin's statement implies that there has been some recent invention or discovery in roll grinding which he is explaining, etc.," there has been no invention but there has been a discovery, namely, that the machines formerly used for grinding chilled rolls were too delicate and light to bring the roll grinder up to a commercial standpoint—hence the roll grinders. This condition is more pronounced where rolls weigh from five to ten tons.

Further, he states that for 40 years completely organized grinding lathes have been on the market and that there has been no substantial improvement either in general design, or even in detail, in that time. This is true of the grinding lathe but he does not seem to understand that the methods I have explained were not of the grinding lathes of 40 years ago, but of the grinding machine of today, which has been improved to meet the requirements of commercial manufacturing.

I am completely at a loss to understand how, after reading my article, anyone could have conceived the idea that I was not explaining a recent invention, when the methods I have explained have been possible only by the heavy and rigid grinding machine of today which is distinctly modern in every respect. If, as Mr. Conradson says, "These machines embodied all the requirements pointed out by Mr. Nevin," they must have been of a construction that enabled them to remove from 1 to 2½ cubic inches of chilled iron per minute. Is this possible with the grinding lathe of 40 years ago?

Finally, Mr. Conradson says: "In my judgment more credit is to be obtained by solving certain grinding problems now facing the mechanical public than by making untenable claims, direct or implied, for old inventions." This statement apparently means roll-grinding lathes and methods were invented 40 years ago and it is useless to try to improve either the machines or methods. If we devote our time to grinding problems, we must consider every proposition that is incomplete in its methods, whether it be roll grinding or any other.

Waynesboro, Penn. W. G. NEVIN.

A Precision Center Punch

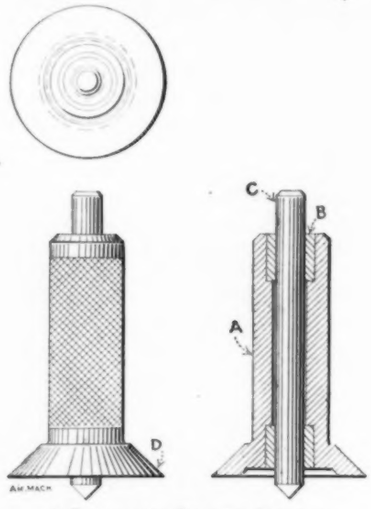
Within the last few months there has been a number of articles published in the AMERICAN MACHINIST on the accurate location of holes in jigs, dies, etc., from center-punch marks.

While there is no doubt that this method is much quicker than the button method, and is also free from the possibility of the buttons moving, still the exact locating of the center-punch mark is a matter of considerable skill.

The accompanying cut shows a center punch that, if properly made and used will give an exact center every time. The body *A* is made of annealed tool steel and has two hardened tool-steel bushings *B*, pressed in as shown. These bushings are lapped out to an accurate fit for the center punch *B*, which is hardened the whole length and then ground and lapped parallel.

After lapping out the bushings, the body is mounted on a true mandrel and the bottom face ground true and square with the hole. Also circumference *D* is ground true and concentric. The circumference *D* is then accurately quartered, and graduated with fine lines.

In using this punch the jig or die is accurately laid out with the hight gage,



A PRECISION CENTER PUNCH

each hole to be bored being located by two lines at right angles to each other. The center punch is then brought over each location and positioned so that the graduations on the circumference of *D* coincide with the lines at right angles, locating the center of the hole to be bored. The center punch is then given a light tap, and the hole is accurately centered.

Where the hole is located near an edge of the jig or die, three graduations are sufficient to accurately center the tool. Of course, on lots of work a center punch of this kind cannot be used, but where it can, it will be found both a time saver and a means to accurate work. It must be thoroughly accurate in all parts and must be used correctly, or else it is no better than the ordinary center punch.

Notts, England. THOMAS JETHART.

Writing for Publication

The contribution of Mr. Towlson on this subject, page 521, will be indorsed by all who have tried this pleasant occupation, and have met with success.

Like Mr. Towlson, I should very much regret to part with the pleasure of writing, and it is after the hard day at the shop that an hour or two at my desk seems most enjoyable.

However, in Mr. Towlson's article no advice is given or anything mentioned, to induce the *young* man with ideas to strike out and increase "his world of acquaintances by the intercommunication of thoughts and ideas." The young man with ideas which he would like to see in print must be prepared to read as well as write and (what is perhaps of more value to him) do a good deal of hard thinking. His grammar may leave

much to be desired but this should not deter him from submitting his ideas, which, if valuable, will be heard of again. Further, he may receive a valuable lesson in grammar by comparing his original manuscript with the printed version.

There may be some who for various reasons are afraid to have their names appear; they may be subjected to a jealous foreman who has no ideas, or they may wish to tell a good story which will cause a fellow workman to laugh, if he does not know its author. This wish is respected by editors, but never use a *nom-de-plume* for a dishonorable purpose. Never make public, ideas that are the property of your employers without permission. Never under any circumstances submit a contribution to more than one editor; I do not know a better way to commit literary suicide. Think carefully before submitting the result of your efforts, and should your article fail to appear, repeat the thinking process.

It is a few years now since I made my first effort in this direction. I was a young journeyman on the bottom step at the time, and had not called home my brains. By some means I devised a labor-saving fixture and I at once, in my own way, prepared my idea for publication, and sent it along, signed by my full name. I would gladly have paid a good sum for it to appear, and my pleasure can be imagined when I saw it in print. I then boldly presented it to the manager. He complimented me and very soon after I received my first stripe.

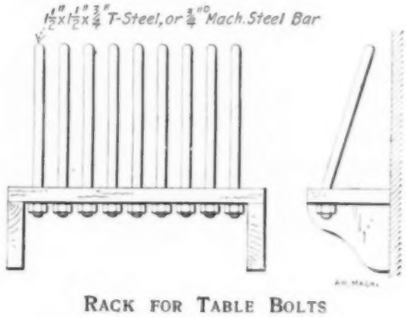
I have submitted a good many contributions since that time; many have been published and many have failed to reach the standard. In stepping up from the so-much-per-hour journeyman to the monthly salary, I owe a great deal to reading and writing.

Belfast, Ireland. F. P. TERRY.

A Rack for Table Bolts

A rack for machine table bolts is shown on page 445.

It seems to have the defect that its use will be neglected because of the omission of one important feature. Bolts



RACK FOR TABLE BOLTS

for securing work are usually found with their nuts on. I am afraid that to take off the nuts to put the bolts into the rack illustrated will defeat its intended use. In spite of standardization and modern methods nuts of a supposed size will not always fit bolts of supposedly similar size. Workmen who secrete such bolts have very good reasons for so doing. A supply of bolts with properly run-down hand-free nuts means much, whether working piecework or not.

I know of nothing so provocative of bad language as to have a number of nuts to tighten down a length of thread the fit of which is such that they cannot be readily turned by hand but are slack enough to render the use of the spanner ineffective.

The accompanying sketch shows a rack to serve the same purpose but permitting of the storage of bolts with their nuts on.

London, England. A. L. HAAS.

Guessing versus Thinking

The article by J. B. Ray, page 746, on expert guessing, brings out a very good point, in that it shows the fallacy of blindly guessing when with a little forethought this uncertain element could have been largely eliminated.

A good way to estimate is to mentally manufacture the article in question, that is thoroughly analyze all operations that are necessary to turn out a finished piece. Determine the type of machine to be used, method of holding the work in place, and then follow each operation through at such speeds and feeds as the metal and machine will stand, allowing such time as is necessary for tool and setting changes. By using this method it will be found that actual performances can be closely approximated by one who is familiar with machine-shop practice. The larger the percentage of machine time to the total time on the piece, the closer the estimate will be. It is when the time is largely hand work that a person's ability to estimate (?) is tested. Screw machines, gear cutters and other machines of this class permit of very close estimates being made, but even under these favorable conditions it is not safe to figure cutting speeds based on some grandstand exhibition.

As an example of the accuracy with which time can be figured, take the following: A contracting firm figured on planing some steel bars. These bars were 2¼x15 inches by 18 feet long and were to be finished all over, the backs to be straight and the front side planed down to one inch thick with the exception of a strip in the center which was to be left 2 inches high and 6 inches wide. The estimator in figuring this proposition ascertained the time it took the planer to make a round trip of 19-foot stroke, then by allowing suitable feeds he determined the number of strokes and the total time for cutting. To this time was added the necessary time for handling, tool setting, and grinding (this was a guess); this time added up gave 50 minutes as the time to finish one foot. Here the guesser came to the fore and decided that one-half hour was ample for the foot and on this basis the work was taken. After the work was complete the time was figured over and totaled to 46 minutes per foot, which was not so bad for an estimate.

If this method of estimating is followed, good results will be obtained as a rule, and as this method calls for the careful watching of handling time, a man's eyes will be opened to the necessity of keeping plenty of clamps and standard fastenings around each tool.

Pittsburg, Penn. T. E. PRAY.

A Suggestion in Making Screwdrivers

An article in the AMERICAN MACHINIST on page 276 by Andrew Webster entitled "Drivers for Starting Stubborn Screws" has prompted me to write a few words on the simple screwdriver. Although the screwdriver is one of the simplest tools, yet it is nearly always improperly made. In this article it is proposed to show the correct method of making the end of a screwdriver so that it will not injure the slot in a screw or slip out when tightening or loosening it.

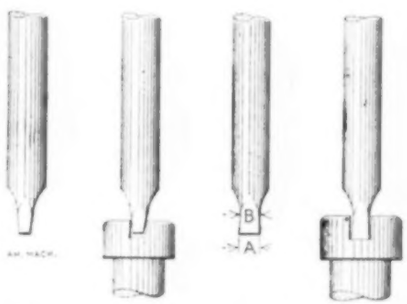


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

WRONG AND RIGHT SCREWDRIVERS

Before showing how the end of a screwdriver should be made, it may be well to call attention to the ordinary or commercial screwdrivers as well as the ones usually found in the shops. In examining them it will be observed that the sides are tapered or wedge shaped, as shown in Fig. 1. The point being the thinnest causes the screwdriver to slip out of the slot in the screw when pressure is applied and mutilate it.

With a screwdriver made as shown in Fig. 1 it is impossible to set a screw as tight as it should be, or loosen a screw that has been properly set up without mutilating the slot.

The method of making a screwdriver which I believe is correct is shown in Fig. 3, which shows the part that enters the slot in the screw slightly thicker on the end *A* than it is at *B*, a little ways from the end. The amount that I would recom-

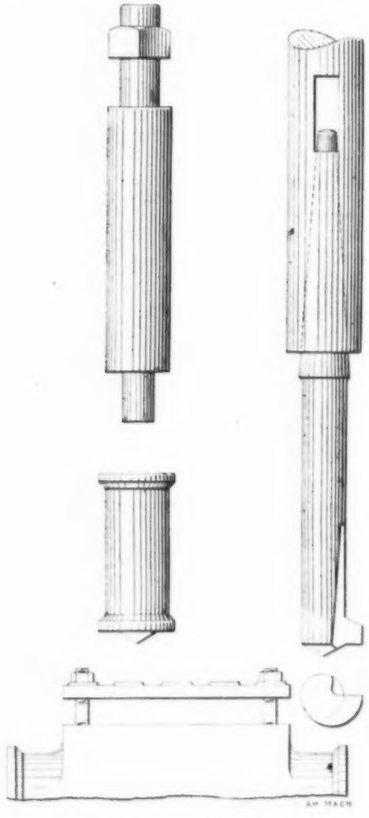
mend is from 0.002 inch to 0.004 inch, according to the size of the screwdriver.

Fig. 4 shows the screwdriver as it would appear in the slot in a screw, except the space between sides of the screwdriver and the slot at the top of the screw head is exaggerated. This is done to bring out the suggestion that if the end of a screwdriver is made a little thicker than any other part that enters the slot, there is no tendency to slip out when force is applied to turn the screw. Screwdrivers made in this manner will enable screws to be set up as tight as required and readily loosened without mutilating the slot.

Detroit, Mich. R. T. WINGE.

An Undercutting Drill

On page 453 is shown a drill ground to undercut at the bottom of tapping holes. A tool for the same purpose, but rather more complete, was shown on page 6, December 8, 1883, over 27 years



AN UNDERCUTTING TOOL

ago, and this had been used two or three years at that time, and they were still in use and of all standard sizes from ¼ to 1 inch. I have often seen the proprietor of the works show these and their work to visitors; but never knew of their being adopted by others.

Syracuse, N. Y. JOHN E. SWEET.

Drivers for Starting Stubborn Screws

Under the above caption, on page 276, Andrew Webster says, "Most of us have had troubles with the slot-head screw that won't come out."

Mr. Webster furthermore declares, "What is wanted is to keep the part that engages the screw from leaving the slot."

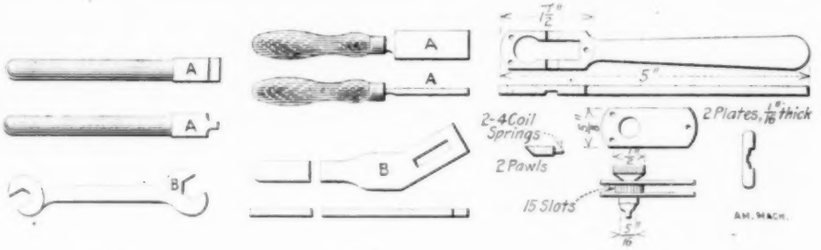


FIG. 1. FIG. 2. FIG. 3.

DRIVERS FOR STARTING STUBBORN SCREWS

When anything is "wanted," it pays to advertise, and here is the answer in this case.

It is evident to all that the farther from the screw head the power is applied, the greater the tendency to tip the driver thereby causing it to slip out of the slot. The simple matter of deduction shows plainly that the closer to the screw head the power is applied the greater the elimination of the tendency to tip, and slip. Therefore, by applying the power to the bottom instead of the top of the driver the trouble ceases to exist.

The great majority take it for granted that the screwdriver is an inexorable law unto itself, but such is not the case, and for the benefit of the novice, the student, or anyone who can think only of a wood-screw when "screwdriver" is mentioned, I wish to impress firmly upon their minds that it is a mere inanimate object, subject to the will of the mind the same as any other tool; and when used as a machinist's tool they should adapt it as such and divorce their minds from all carpenters' screwdriving tool influence and associations.

Furthermore, when it is misused it becomes, on account of its tool-steel structure, a shearing tool, ready at all times to shear off what small bearing surface the driver has, and it behooves the operator to *stop* the moment he feel the least tendency to slip. The same old ounce of prevention. Figs. 1 and 2 are self-explanatory.

The left hand, and body, can be used on the handle of the driver to steady it in the slot and keep it from slipping, while the strong right arm is used on the wrench *B*, applied close down to the head of the screw.

Old files are excellent for the purpose of making the flat driver and wrench, Fig. 2, and a piece of pipe flattened at one end to fit over the end of the file makes an excellent handle when taking out large and troublesome screws.

For the benefit of the few who may consider that a simple screwdriver is so utterly commonplace as to be unworthy of mention, I take this opportunity to introduce the ratchet screwdriver, intended for use where the space is limited, which I believe, according to Fig. 3 is complex enough to suit the most fastidious. Thus, I raise that much despised tool to a plane which shows class, and all three of them bid fair to hold their own in fast company for some time to come.

Chicago, Ill. W. FISCHER HOLL.

The Ring Gage Problem

With reference to the trigonometrical solution of a "Ring Gage Problem," appearing on page 510, I venture to suggest that the diagram is not quite complete.

Thus, in the equation

$$r = BC - b,$$

the point *B*, not given on the diagram, is presumably the center of one of the circles of radius *b*.

The point *M* should also be marked where the circles of radius *r* and *R* are tangent.

This solution appears to involve less work than the solution given by Mr. Webster, page 896, Volume 34.

London, England. E. H. SMYTHE.

The location and area of the core room are of more importance in the production of castings than most foundrymen realize, since the modern tendency in certain classes of work is to throw an ever increasing responsibility on it, and some complicated castings such as air-cooled automobile cylinders are made in molds that are composed entirely of cores. The definition of a core as already given was carefully chosen with this phase of the subject in mind. The location depends upon several factors: the size of the individual cores, the number of pounds of cores used per molder per day, the strength of the individual cores and the method of handling the cores from the core room to the molders.

November Meeting of the A. S. M. E.

The November New York meeting of the American Society of Mechanical Engineers was held in the Engineering Societies' building on the 14th. The chairman of the meeting, H. R. Cobleigh, presented a very excellent paper, covering generally the apparatus used in the different methods of autogenous welding, with especial attention given to the flame processes. The manner in which he conducted the meeting was particularly pleasing, and made it possible to cover an exceptional amount of ground during the evening—besides, he kept discussion lively and did not permit interest to lag.

The Thermit Process

G. E. Pellisier read a paper on thermit welding. Mr. Pellisier outlined the chemical reactions that take place in thermit welding, and described the details in connection with making a weld. Mr. Pellisier showed slides that were descriptive of representative repairs made by this method of welding. He concluded his paper with a series of moving pictures, showing a thermit weld being made. Incidentally, the moving pictures commended themselves to the audience as an excellent way of illustrating the detailed operations of a process.

Electric Welding

C. B. Auel read a paper on electric welding, of which he has made an exhaustive study. He outlined the different processes and discussed their features. In speaking of the fillers and fluxes used, Mr. Auel stated that when welding steel and wrought iron, the filler may be soft Norway or Swedish iron, trimmings from boiler plate, bits of broken steel castings, or the like; it is permissible to use copper wire or rods of special cast iron, which is high in silicon. As a rule, flux is not necessary in the welding of steel or wrought iron. However, it is frequently used in connection with cast and malleable iron and numerous patents have been taken out along this line. A flux considered by many practical welders as being very good consists of: Red oxide of iron (Fe_2O_3), 15 to 25 per cent.; borax, pulverized ($Na_2Bo_4O_7 + 5\,H_2O$), 85 per cent. to 75 per cent.

Another flux consists of: Oxide of copper (CuO), 5 per cent.; oxide of manganese (MnO_3), 15 per cent.; red oxide of iron (Fe_2O_3), 30 per cent.; borax, pulverized ($Na_2Bo_4O_7 + 5\,H_2O$), 50 per cent.

These fluxes may be used either dry or wet. In the former case the flux is shaken directly into the weld a little at a time as it is undergoing formation; in the latter case, a paste is made, and the filler rod is then coated with it and allowed to dry before using.

The Discussion

W. H. Brown made a few remarks on electrical resistance welding and explained particularly spot welding.

J. D. Mooney presented some figures to show how autogenous welding has reduced the cost of locomotive repairs. The figures were supplied by H. W. Jacobs, of the Santa Fé railroad.

W. J. Fritz described the difficulties encountered in cutting up the wreckage of the battleship "Maine," and how they were overcome by means of the oxy-acetylene torch.

Others who took part in the discussion were W. H. Spire, Henry Cave, W. H. Noxon, J. Levin, Nelson Goodyear, F. A. Saylor, J. F. Springer, Doctor Lieber and E. B. Katte.

Slide Rule for Timing Work on Variable Speed Planers

The engravings illustrate applications of a new form of slide rule brought out by the Cincinnati Planer Company, Cincinnati, O., for determining the length of time required to machine work on planers under varying conditions as to cutting speed, return speed, and rate of feed. The rule is adapted for computations involving cutting speeds from 20 to 60 feet per minute, return speeds from 50 to 130 feet per minute, and feeds ranging from $\frac{1}{16}$ to 1 inch per stroke.

The upper portion of the rule has in place of the usual "A" scale, a set of curves representing the different cutting speeds, and the points of intersection with the horizontal lines representing the different return speeds, determine the setting of the slide, scale B of which represents the various rates of feed from $\frac{1}{16}$ to 1 inch. Scale C of the slide is graduated for surface areas up to 3000 square inches, and scale D gives in minutes or in hours the time required to plane any given area.

The area of the surface to be planed, that is, the length in inches times the breadth, in inches, is determined at the outset in the usual manner, either mentally or otherwise, as may be most convenient.

Assume, for example, that the work under consideration is 10 feet long by 12 inches wide, and a cutting speed of 40 feet, return speed of 100 feet and feed of $\frac{1}{8}$ inch have been selected as suitable: Scale B is set as in Fig. 1, with $\frac{1}{8}$ under the point of intersection of the 40-foot curve with the line representing a return rate of 100 feet, and opposite 1440 on scale C (length times breadth in inches), read 33.6 minutes.

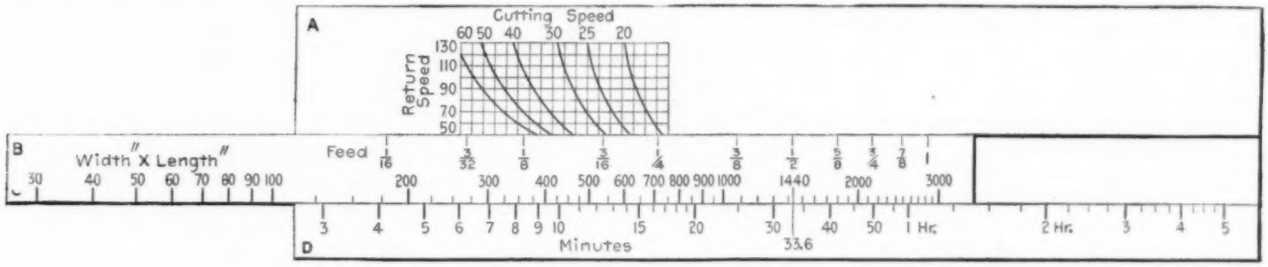


Fig. 1. Slide Rule Set for Cutting Speed of 40 Feet, Return Speed of 100 Feet, Feed of $\frac{1}{8}$ Inch

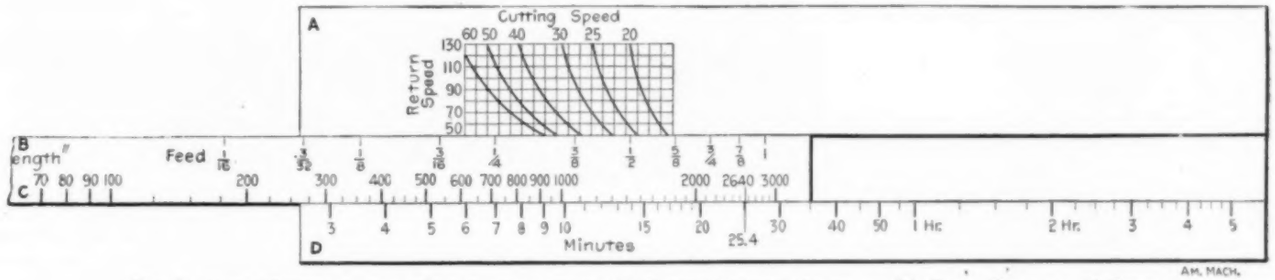


Fig. 2. Slide Rule Set for Cutting Speed of 30 Feet, Return Speed of 90 Feet, Feed of $\frac{3}{8}$ Inch

Or, suppose the work to be 11 feet long by 20 inches wide and the surface to be gone over therefore 2640 square inches. Also assume a cutting speed of 30 feet per minute, a return speed of 90 feet and a tool feed of ⅜ inch have been selected. The slide rule is now set, as in Fig. 2, with the ⅜ line of the B scale directly under the intersecting point of the curve for 30 feet and the line for 90 feet return speed. Opposite 2640 on the C scale, will then be found on the D scale 25.4 minutes as the time necessary to complete the operation.

Moving Pictures of the Working of a Steam Hammer

By Alfred Gradenwitz

The cinematograph has afforded a most welcome means of studying movements too rapid or too slow to be examined with the eye, enabling, for instance, the flight of insects and the growth of plants to be observed in all their phases, and allowing even the life of the infinitely small, the world of microbes, to be made accessible to scientific investigation.

An Austrian engineer, O. Fuchs, professor at the German Technical High

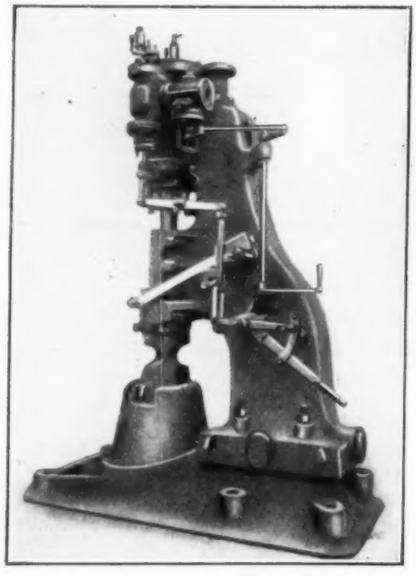


Fig. 1. The Steam Hammer

School, at Brünn, has put the cinematograph to an ingenious application by using it for a technical investigation of steam hammers.

Previous researches had shown the impossibility of obtaining with the ordinary process any satisfactory indicator diagrams of steam hammers, allowing the distribution of steam to be investigated and the striking power obtainable with self-contained slides and under ordinary working conditions to be ascertained. This is why Mr. Fuchs devised the cinematograph arrangement described in the following:

A paper tape performing a continuous motion passes over the drums of two indicators connected to the two sides of the cylinder and the styles of which accordingly record steam tensions in the form of the ordinates of an uninterrupted curve. The paper tape is moved by an

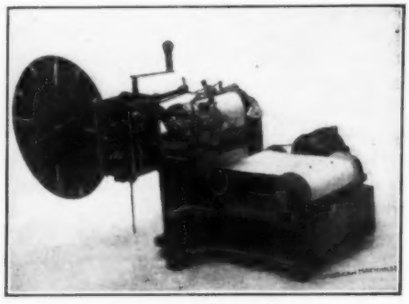


Fig. 2. Cinematographic Arrangement

electric motor, acting through the intermediary of a gearing on a metal drum, which presses the tape against a caoutchouc drum, thus carrying it along by friction. A clockwork, which at each half second deflects from its normal path, a style recording a straight line on the tape, subdivides the pressure curves into time intervals.

However, the interesting point in the present case is, not the connection between steam tension and time, but the path of the piston or ram. Now the motion of the ram is registered cinematographically by means of a light index fixed to the ram and moving alongside a scale divided into centimeters. As each single view on the film thus represents the index in the actual position of the ram, their succession allows the paths traversed by the piston and the ram in the interval between each two views to be ascertained. In order to allow the time to be measured, some kind of clock is so arranged on the recorder as to appear on the cinematograph film beside the hammer itself.

The paper tape thus gives the steam tensions in terms of time, while the film gives the path of the ram, likewise in terms of time. As the index is actuated by the clockwork recording the time intervals, the connection beteween these records, namely, the tension corresponding to each given position of the arm, is readily ascertained.

The tension recorder is arranged immediately beside the hammer, but quite independent of the latter on a wooden jack, the feet of which are fitted with substantial felt plates damping any vibrations.

On the film thus obtained the scale traversed by the ram index is plainly visible on the right side, while to the left is seen the clock dial fixed to the tension recorder. The arrangement is lighted with an arc lamp in such a way as only to allow parts of technical interest to come out on the film.

From the results of this investigation it is seen that steam hammers are far more economical in working than is generally supposed. Moreover, the principles of most favorable steam distribution, as established by Mr. Fuchs, and from which most satisfactory results have been derived in connection with quite a number of hammers in course of actual operation, are found always to be very economical. The cross-sections of canals at the lower end of the cylinder, for instance, should be of ample dimensions, because of the influence exerted by recoil and the hight of the sample. The draining of the compartment above the piston is found to be very important with a view to preventing any excessive increase in back-tension, as well as a diminution in the entering tension. The recoil is found to reduce by 25 per cent. the time necessary for each operation, while the time required for lifting the ram during the first stroke is 1.9 times, and during the following strokes 1.4 times the duration of the downward stroke. The recoil is found to yield 45 per cent. of the required lifting energy, and the striking power is about double the figure corresponding to gravity alone. The consumption of steam is about 55 to 65 pounds for each horsepower-hour.

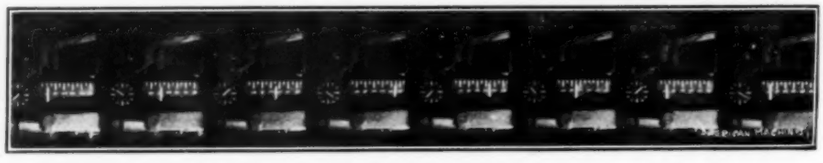


Fig. 3. Portion of Film

Brass or bronze must be melted in graphite crucibles. These are heated in a small pit furnace fired preferably with coke or anthracite coal, though it may be fired satisfactorily with charcoal. Oil-fired furnaces are also on the market and in regions where fuel oil is plentiful a satisfactory oil furnace can be made by building a small firebrick pit about six inches greater in diameter than the diameter of the crucible to be used. The crucible should be set on a small pier of brick built in the center of the furnace, or it may be placed on an old crucible turned bottom side up. The oil flame should enter near the bottom tangentially, so that it will circle around the pot; the outlet for the gases should be near the top of the furnace.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For October,* 1911 *(American weekly, American monthly, English weekly and German weekly) total,* 94,750.

Of this issue 21,750.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 133

American Machinist

Country or City Shops

The question of general factory location has been brought up again. Dr. Harvey W. Wiley, chief of the Bureau of Chemistry of the United States Department of Agriculture, in a recent address advocated the passing of laws to prohibit factories in large cities. What he wished to bring about was placing workingmen and their families amid surroundings where they could have plenty of fresh air, inexpensive food and good sanitary conditions. Thus the question of city or country shops is put before us from the viewpoint of national health. Although we will not have such drastic laws as Doctor Wiley suggested, yet the question is worth considering.

When a report is to be made on a proposed factory site, the investigator usually looks into its nearness to markets for raw material and for finished product, the transportation facilities to and from those markets, the available supply of labor within a five-cent fare, surrounding land values, taxes and other fixed charges, available supply and cost of power and the like. But from now on he must consider any and all surrounding conditions that affect the health and welfare of the workmen to be employed.

This is clearly a broadening of viewpoint and a further recognition of the movement which is gathering headway to improve the conditions surrounding the working place and the worker. Were it necessary, a large number of examples could be cited where manufacturing firms —many of them machinery builders— have abandoned city plants, moved out into the country and there built new buildings with approved facilities for heating, lighting, ventilating, sanitation, and so on. The better of these plants have erected low buildings, as a maximum four or five stories in hight, have provided ample courtyards and have entirely eliminated the shocking conditions found in many city shops.

To strengthen the contrast compare a development of this kind with many of the working places in New York City, as revealed by recent reports. Although we may not recognize it, New York is the greatest manufacturing city in this country, and however much we may look upon it with disfavor, its factory buildings and its factory population are steadily and rapidly increasing.

If we accept the economist's proposition that the country should be the place of production and the city the place of exchange, we have yet another argument for the country shop. But turning to conditions affecting health, in the city the workingmen cannot hope to own his own home, for he must live in some building, be it a multi-storied house or an apartment block, whose roof not only shelters him and his family, but many others besides. In the country he can hope to own his own home, and many do so. Food values should rule lower in the country than in the city. In many commodities this holds true, though not in all. With proper attention the kitchen garden on a very small piece of land can provide a family with vegetables, far better in quality than can be purchased, at a trifling expenditure of money. Again the fresh air in the country is more easily appropriated and enjoyed than in the city.

To sum up briefly, country living conditions should promote a higher standard of health than those of the city.

Although the advantageous results from providing the best of working condition upon production and of the welfare of the workers are not generally tabulated and known, yet no one is disposed to question their existence or value. Every employer desires to have his employees in the best of physical condition, knowing that such promotes efficiency. This is beginning to be recognized as an important factor in production.

Once admitting that working people can live healthier and happier in the freedom of the country than they can in the shut-in conditions of the city, and admitting that an increase in their well-being is of direct advantage in production, we have a most powerful argument for the country shop.

Gear Guards on Machinery

It is interesting to note that the growing practice among tool builders of equipping their machines with guards has been accompanied by a general development in the ideas of the users as to how thoroughly gearing and other dangerous mechanism must be covered to be entirely safe in operation.

While often in the recent past the application of guards has been upon request of the customer, or to conform to the requirements of State factory laws, today there are tool builders who frequently go beyond what is actually required in the way of providing protection against possible injury from gears. Yet, unless all gearing is fully inclosed there is always the possibility of users demanding that the next machine ordered must be equipped with a complete system of guards, for they are rapidly becoming aroused to the desirability of adopting this precaution against accidents.

An instance of this nature occurred recently where a lathe was delivered to the purchaser with what the builder considered fully adequate gear guards, but which the buyer refused to accept until a guard that extended three-fourths of the way around a back gear was replaced by one which inclosed the rim and face completely. In another case the purchaser demanded that a slowly moving gear which was visible from the end of the apron, but which was not actually exposed in the sense of being dangerous, should be covered with a plate to assure absolute protection.

Such instances are typical of the demands made by some machine users who perhaps a few years ago would never have thought of placing even a tin or wood shield around the gears on their machinery. Although some of these ideas may seem finical, they are undoubtedly along the right direction, a fact recognized by the most progressive tool builders.

Incidentally, makers of lathes and other tools are appreciating the fact that a well guarded machine aside from its practical advantages in protecting the operator, presents a much neater appearance to the eye.

Richmond Viall

Richmond Viall, superintendent of the Brown & Sharpe Manufacturing Company since 1878, died November 16. Practically his whole life was spent in the employ of this company, although he had taken no active part in the conduct of the business for several years previous to his death. His name, however, will always be associated with the success of the firm.

Richmond Viall was born in Barrington, R. I., December 16, 1834, a descendant of an old New England family which came to this country from England. His early schooling was received in East Providence, to which town his father had moved. Leaving school at seventeen, he learned the jeweler's trade in the employ of Briggs, Hough & Stone, a business afterward conducted under the name of Wightman & Hough. He served a regular apprenticeship of three years, and remained with the firm one year thereafter. In 1857 he went to Attleboro and continued working at his trade until the Civil war broke out. At this time he abandoned it for another occupation. For a while during the war he was engaged in the manufacture of cavalry sabres.

On January 6, 1863, Mr. Viall came to Providence and entered the works of J. R. Brown & Sharpe as a screw-machine hand. He became foreman of the work in the screw-machine department, January 1, 1864, having 37 men under him. At that time a large part of the company's business consisted of the manufacture of the Willcox & Gibbs sewing machines. When, in 1872, the plant was moved from its location on South Main street to its present place of business, Mr. Viall was given complete charge of the sewing-machine work. On February 16, 1878, he was made superintendent, a position which he held until his death. He retired, however, from active work in 1902.

When Richmond Viall became superintendent in 1878, the country was just beginning to recover from a financial panic of several years' standing, and at the time the number of men employed was less than 200. The business began to grow from that time onward, and when he retired in 1902 the men numbered more than 2000 and the floor space had increased to about 360,000 square feet, or 8½ acres.

During the years which followed the beginning of Mr. Viall's superintendency in 1870, his personality became a most important factor in the business. Not only was he fitted to superintend the practical operations of a large shop, but his very democratic spirit, his keen insight into human nature, his loyalty and his fine sense of honesty all united to make him the man that he was in the business he helped expand.

His success was a success day by day. Although he was not a great mechanic and the name, "a soft-solder jeweler," which he gave himself, is still fresh in the memory of many, he had a highly developed discernment and appreciation of things and men mechanical. To this faculty, coupled with his executive ability and uniform integrity, must be attributed his highly successful life..

Primarily Richmond Viall was a just man. No one possessed a higher sense of honor than he, and in his business relations all testify to his square dealings. This determination to be honest with all probably made him as many friends as any other one characteristic of his life. It was because he could be depended upon that he was made superintendent of the Brown & Sharpe Manufacturing Company. Everywhere this trait was recognized, and it is doubtful whether there is a person of the hundreds that have worked under him, many of whom are holding leading positions in the country

RICHMOND VIALL

today, that would hesitate to pay him the same tribute. And this spirit of honesty in turn secured loyalty, the trait that was characteristic of all his dealings with the men and the company.

He studied his men and learned their peculiarities. Although he governed the shop by certain well defined rules, he knew perfectly well that the same interpretation could not be applied to everyone. And to his sound judgment of men must be added a very accurate knowledge of the art of shop management.

No more striking example of the willingness of a man who is at the head of an establishment to work with his foremen, and give each man credit for his work can be found than in the case of Mr. Viall. He was not bothered with petty jealousies, nor would he allow them to arise among his men.

Another phase of his executive ability is found in the tactfulness with which he handled men. In an establishment the size of the Brown & Sharpe Manufacturing Company, it is inevitable that differences of opinion will occur among men, and the problem before the superintendent is that of maintaining harmony. He may employ various methods, but in the last analysis it is always sound judgment coupled with a certain degree of flexibility in applying the rules of the shop to the case in question that brings about an amicable settlement. In dealing with such cases, whether it was one of conflicting policies or a petty dispute among men, Mr. Viall met the issue squarely, and by reason of his power of appreciating both sides, he seldom failed to satisfy those concerned.

In Mr. Viall's judgment the dissatisfaction and unsettled feeling which often arises in the shop are caused in a large measure by unfair rivalry and misunderstandings between the foreman and the workman. To that end, he emphasized the law of mutual helpfulness, believing fully that coöperation increased the value of both the skilled and unskilled workman and also tended to unify and harmonize shop life.

No record of Mr. Viall's life would be complete without some mention of his kind and sympathetic nature. Many men in the shop remember him for this one trait alone. So thoughtful was he of the welfare of the men that he often visited them, searching out among them those he thought might need his help. It has been said that he was imposed upon many times, but it might be added, and unhesitatingly too, that he would rather be imposed upon than injure anyone.

Many times he made mistakes and always if he found by his erring somebody had suffered, he sought that person out immediately that he might apologize. He was loyal, not only to the company, but to the men. "There are two sides to a question," he would say, "and I cannot pass judgment until I have heard both." In all his acts as superintendent it was his constant attitude to avoid snap judgment, and his chief aim with the thousands of workmen with whom he came in contact was that justice prevail.

Mr. Viall was married in 1859 to Eliza M. Cole, four children being born to them, one of whom, William A. Viall, is now secretary of the Brown & Sharpe Manufacturing Company.

Addition to McGraw-Hill Book Company

The book department of the Engineering News Publishing Company has been purchased by the McGraw-Hill Book Company, 239 West Thirty-ninth street, New York. This adds to the list of the McGraw-Hill Book Company, a considerable number of important standard treatises, primarily in the field of civil engineering.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

New Higley Cold Saw

A cold saw of new design, known as the Higley, No. 28, is being manufactured by the Higley Machine Company, Croton Falls, N. Y.

This machine, shown in front and rear views in Figs. 1 and 2, will cut I-beams or other material, up to 20 inches wide and 7 inches high. The 28-inch saw cuts from above, instead of from below, as in previous designs by this firm, which makes it much easier to set work in line with the saw according to marks made on the upper surface. Another new feature and one which also assists greatly in bringing the work right with the saw, is that the table has a lateral movement of three inches, so that the work may be clamped approximately in line with the saw and then brought exactly so by using the cross-feed screws of the table, which are operated by means of a crank.

The cutting speed of the saw is 32 feet per minute and it is operated by the firm's well known method of a toothed wheel, meshing with holes in the saw, which is driven through bevel gears from a 5-horsepower motor.

There are three changes of feed, ½, 1 and 1½ inches per minute, obtainable by shifting the belt on the three-step cones shown at the right in the second halftone.

The saw is fed into the work by means of a circular rack on the saw frame into which a pinion, driven through a special transmission device, meshes. This transmission is shown in detail in Fig. 3, and is somewhat similar to the one described at page 469, Volume 31, Part 2. It is so made that if the saw should catch from any cause, the friction disk in contact with the cone pulley will slip and stop the feed, avoiding breakage of the saw. The amount of power required to cause this friction to slip may be increased or decreased by moving the hand-lever which changes the tension on the heavy coil spring.

The saw frame is counterbalanced by means of a cable running over pulleys to a weight inside the hollow column. A pump connected to the driving shaft by sprockets and chains, furnishes lubricant to the saw from a tank in the base.

The machine occupies a floor space of 3 feet 10 inches by 7 feet 7 inches and weighs approximately three tons.

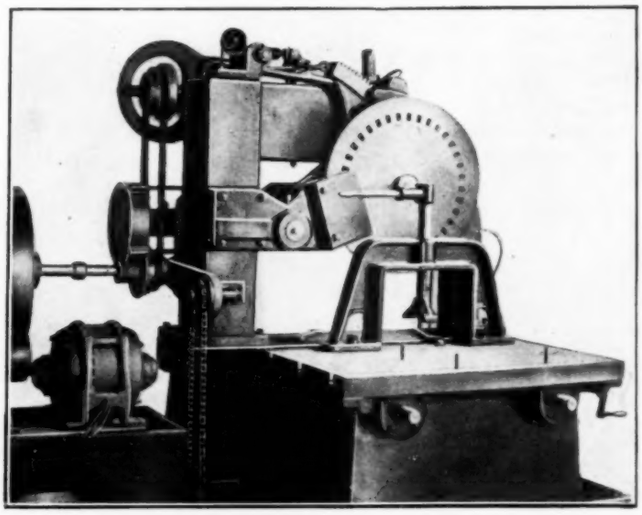


FIG. 1. NEW HIGLEY COLD SAW

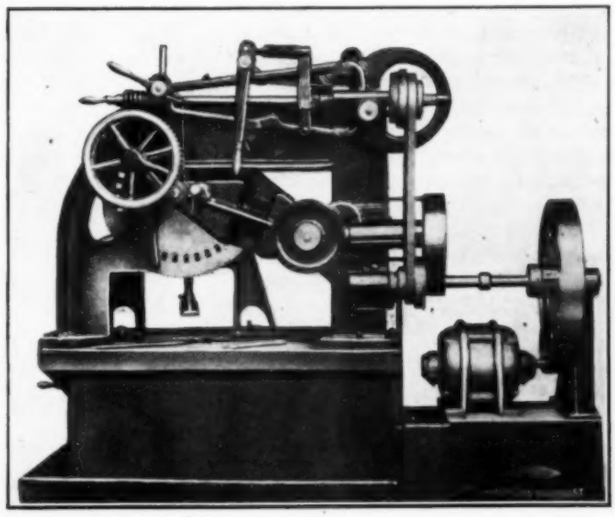


FIG. 2. THE FEEDING AND DRIVING MECHANISM

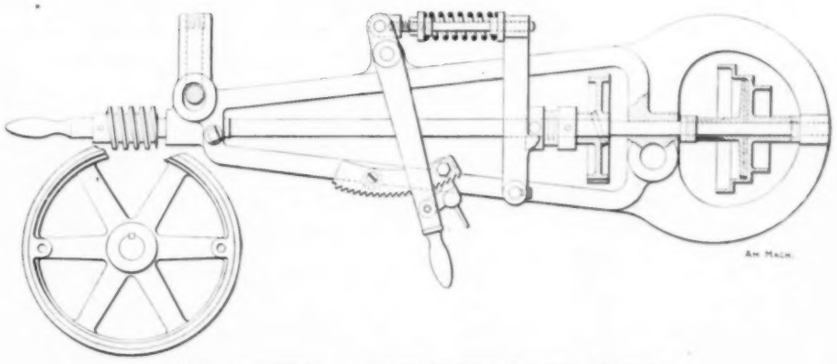


FIG. 3. DETAILS OF THE FRICTION FEED DEVICE

A New Swiss Engine Lathe

The newest machine exhibited at Turin by the Société Suisse pour la Construction de Machines-Outils Oerlikon, Oerlikon, Zurich, Switzerland, is a lathe of about 18 inches swing by 59 inches between centers. It will turn about 15 inches over the carriage. The drive is

by gears and a three-speed cone for 3¾-inch belt. The spindle has a 1½-inch hole through it and carries a center No. 5 Morse taper. There are six gear changes for each belt change, giving 18 speed changes in all from 10 to 510 revolutions per minute. The weight of the tool complete is about 7040 pounds. With

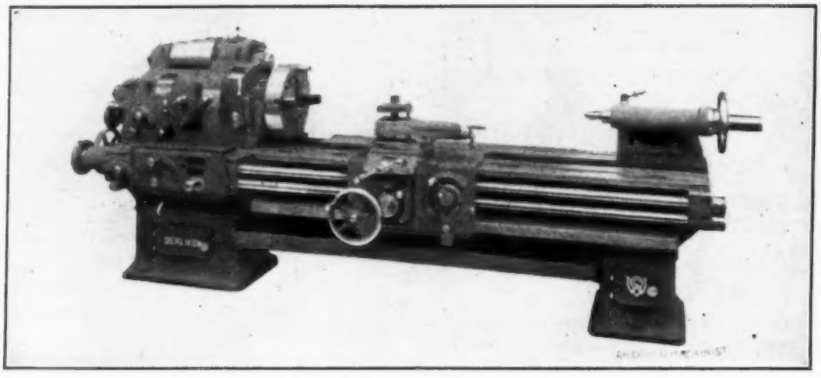


FIG. 1. A SWISS ENGINE LATHE

a cut 0.295 inch deep, 0.063 inch feed at 98 feet surface speed, 375 pounds of steel has been removed in an hour.

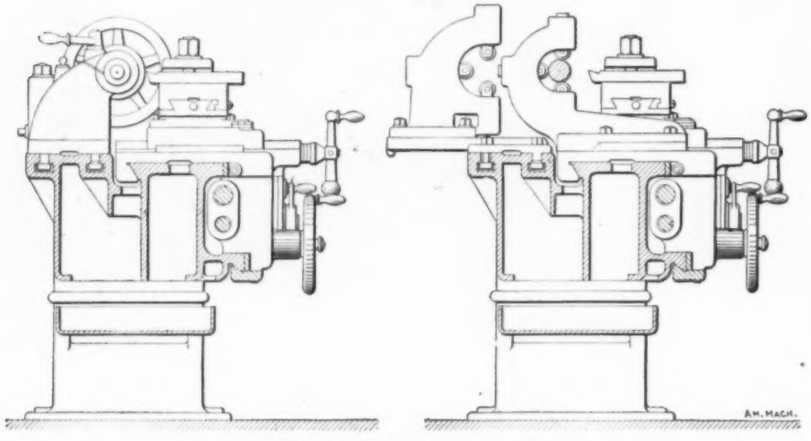
The feature of the machine from an American point of view is the bed. A general view of the lathe is given in Fig. 1. Figs. 2 and 3 show sections of the bed. It will be seen that the ways for the carriage and the tailstock and steady rests are quite distinct. The ways are flat and the carriage is carried on a lower way at the front. There are two lead screws, one coarse and one fine pitch. The fine-pitch screw is used as a feed screw and is splined so that it can be used with friction gears in the usual way.

The steady rests are secured on the rear member of the bed and can be slid back out of the way as shown in Fig. 3, so that the follower rest on the carriage can clear them. The steady rests support the work on rollers carried on ball bearings, or in place of rollers the ordinary metal or wood jaws can be used. The lathe can be used for grinding, in which case a small grinder is secured to the carriage and is driven by pulley or motor, as convenient, back rests for the job being secured to the rear member of the bed.

The thrust on the spindle is taken by balls. The speed and feed changes are obtained by convenient levers in the head. The engagement of the carriage with either screw is obtained by a double nut so arranged that both screws cannot be engaged at the same time.

A Square Hole Miller

The R. K. LeBlond Machine Tool Company, Cincinnati, Ohio, has designed for the Niles-Bement-Pond Company, a combination machine tool which is not only adapted for milling square holes, but also possesses all the features of a standard miller.



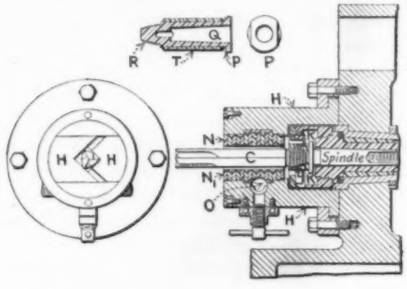
FIGS. 2 AND 3. LATHE BED IN SECTION

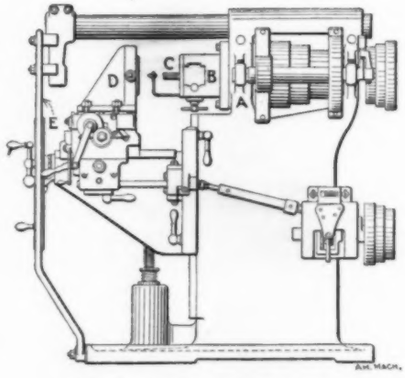
The machine is designed along the lines of the No. 2 plain miller with such changes as are of advantage to the successful operation of the square-hole cutters.

The principle used in this work is the same as employed in other devices, namely, the revolution of a triangular end mill, in a stationary master guide, which in appearance is much like a regular drill chuck. This stationary guiding chuck is fastened directly to the column of the machine by means of a flange, which entirely eliminates all lost motion.

The cutter receives its motion from a special driving member fastened to the nose of the spindle. This driving member not only causes the cutter to rotate, but at the same time gives it freedom to travel eccentrically in the master guide.

The whole arrangement for cutting square holes is easily detached, leaving the machine ready for regular milling work. As it is advantageous when cutting square holes in tough material to previously drill a round hole, the machine is furnished with an appliance for operating ordinary twist drills which engages in the arrangement for boring





A SQUARE-HOLE MILLER

square holes. Both operations can be done in succession in the same workpiece.

As the attachment for cutting square holes projects considerably beyond the nose of spindle, it would on a standard machine decrease the working space in front of the cutter. Therefore, the column, bearing the main spindle, has been set back to gain the distance taken up by this projection, thus maintaining the full working range of the table.

In order to secure rigidity of the work pieces on the table, a special brace is provided which connects the knee with the overhanging arm as well as with the base of the machine.

As the cutting of square holes requires a very fine feed, the machine is arranged with two separate cross feeds, one for regular milling work and the other for extra fine feeds starting from 0.001 inch.

The column with main spindle bearing *A* is shown in the elevation. The detachable chuck for cutting square holes is shown at *B*. The cutter *C* is also shown in the sectional view. A special vise *D* for holding work is provided. The special brace *E* connects the knee with the overhanging arm and base *G*.

The square-hole arrangement shown in this cross-section consists mainly of the driving member *K* which is screwed to the nose of the spindle and the stationary guiding chuck *H*, which is bolted to the column over the main bearing.

The driving member contains a floating driving dog *L*, into which cutters *C* are screwed by means of a taper thread. Behind this dog is a floating thrust plate which takes up the end thrust of drills.

The stationary guiding chuck contains the master guide, which consists of two jaws *N*, *N*1, forming an adjustable square guiding hole which the drill *C* is forced to follow.

A right- and left-hand screw *O* opens and closes these in accordance with the size of drill used.

For boring round holes in connection with the arrangement for cutting square holes, a round bushing *T* is inserted in the square guiding hole, which serves as a bearing for the shank *R*, which contains a regular Morse taper *Q*. This shank is fastened in the driving member by means of the taper thread *R*, and describes a regular revolution inside the bushing *T*.

The range for boring square holes is from ¼ to 2 inches.

New Marine Turbine Reduction Gear

To construct gearing for the transmission of large powers at unusually high tooth speeds presents serious problems. The most serious problem confronting the designer of such a system of gearing has been the development of a mechanism to insure an elastic, uniformly distributed tooth pressure between gear and pinion to avoid the concentration of an excessive tooth pressure at any single point of the working face, which would result in rapid deterioration and ultimate destruction of the teeth. A solution of this problem is shown in the accompanying illustrations of a Westinghouse marine turbine reduction gear. Fig 1 is a perspective view, partly in section, of one of the gears installed on the U.S.S. "Neptune." Each gear transmits approximately 4000 horsepower at a speed of 1250 revolutions per minute for the pinion shaft, and about 130 revolutions per minute for the low-speed or driven shaft. The novel feature is the hydraulically supported frame which carries the pinion shaft and its bearings, and by virtue of which the pinion shaft is self-alining. The action of this hydraulically supported frame may be more easily understood by first inspecting Fig. 2, a purely diagrammatic section. The frame *A* carries the bearings of the pinion shafts, *D* is a part of the main casing, and *E* is a rigid strut or beam secured to the main casing by means of a series of steel columns. It will be noted that *A* does not fit closely between the parallel faces of *D* and *E*, but has freedom for a slight upward and downward movement.

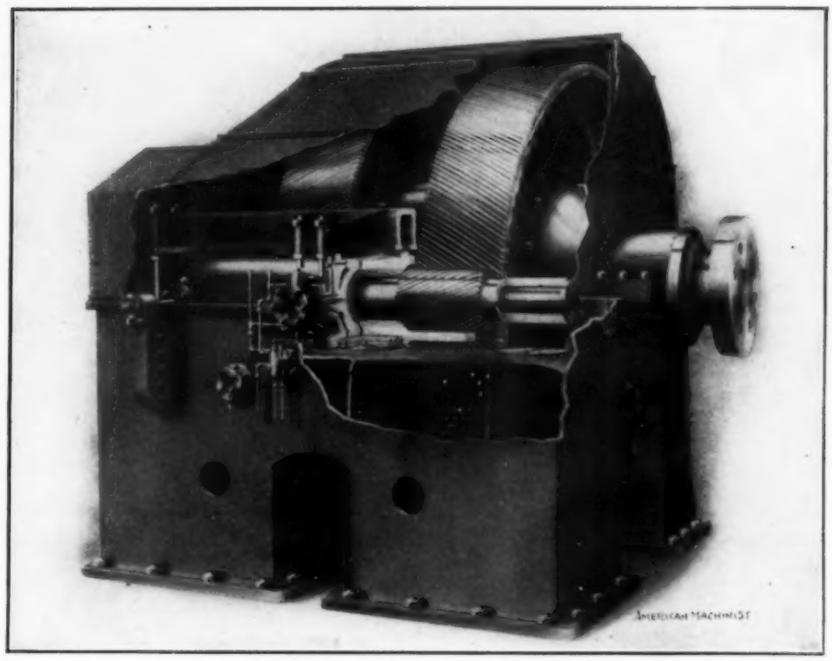


FIG. 1. NEW MARINE TURBINE REDUCTION GEAR

On the upper and lower surfaces of *A*, are three circular pads bored out to form shallow cylinders in which are fitted short pistons *C*. The passage or port 1 communicates winth the three shallow cylinders on the lower side of the frame *A*, and a similar port 2 communicates with the corresponding cylinders on the top side of *A*.

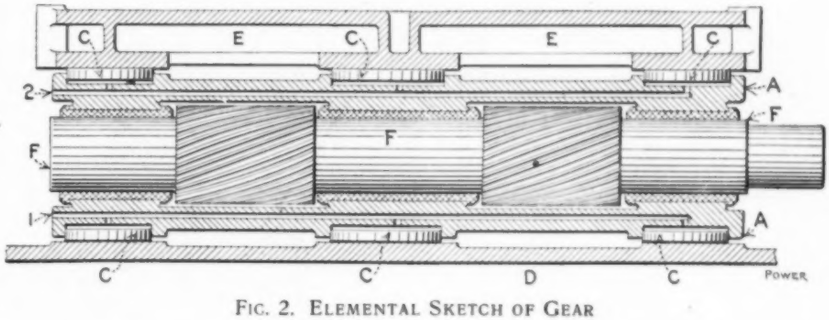


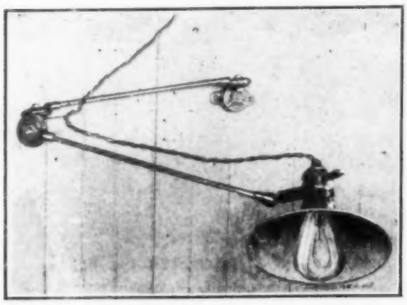
FIG. 2. ELEMENTAL SKETCH OF GEAR

When the gear is working, the reaction on the pinion teeth tends to force the frame *A* against the casing *D* or the beam *E*, depending on the direction of rotation. If the reaction on the pinion teeth tends to force the frame *A* downward against *D*, then if oil or other suitable fluid under sufficient pressure be introduced at 1, it will be readily seen that the frame *A* will be lifted clear of the casing, and will actually float on the fluid in the cylinders. Similarly, if the direction of rotation be reversed so that the tendency is to force the frame *A* against the beam *E*, the introduction of fluid under pressure at 2, will prevent the frame *A* from coming in actual metallic contact with *E*. Since all three cylinders of the set that may be in action are connected to the same source of fluid supply, the slightest difference in tooth pressure on either side of the middle point of the pinion shaft *F* will cause the frame *A* to yield at the point where the pressure is unduly high. In thus yielding, the excess pressure is relieved, and automatically transferred to the point in the working face of the pinion at which the tooth pressure was, at the instant, below normal.

The broad underlying principle of the design is, therefore, the supporting of the pinion shaft in a frame which literally floats on oil, and which has no metallic or other rigid connection to the main casing. The practical application of this principle involves the accurate and automatic regulation of the fluid pressure in accordance with the load on the gear.

Lamp Bracket

The lamp bracket shown herewith is of a design especially adapted for machine-shop use. The light can be instantly moved to any desired position, vertically or horizontally. The universal joint used in the bracket permits vertical and horizontal movements, and maintains uniform tension.



LAMP BRACKET

The arms are of solid steel, and the brackets may be attached to the wall, machines, etc. They are 30 inches long, thus giving a total range of 5 feet and are aluminum finished.

The brackets are a recent product of the McCrosky Reamer Company, Meadville, Penn.

Cincinnati Slow Speed Planer Drive

The illustration shows a 36-inch planer with electrical variable-speed drive, having an additional slow-speed arrangement through gears for machining extremely hard castings, such as chilled rolls. These slow speeds are also very applicable to work of irregular shape or wide surfaces, which are finished by a form tool and slow speed.

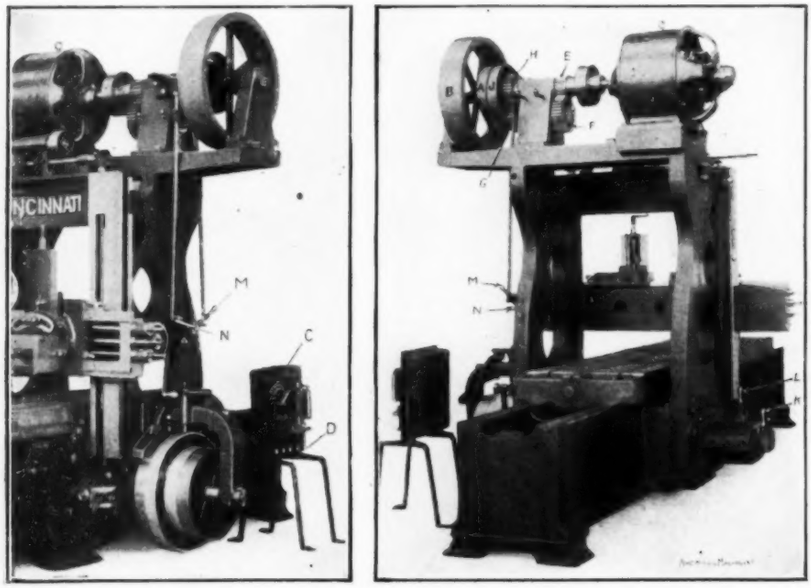
The planer is driven by a 2 to 1 variable-speed motor directly coupled to the top shaft, which runs in ring-oiling bronze-bushed bearings, and carries the regular cut and return pulleys *A* and *B*, keyed to the shaft. The cutting and return speeds are changed by setting the handles *C* and *D* on the controller to any predetermined speed. The drive constitutes the regular arrangement, giving cutting speeds of 27 to 54 feet per minute, and return speeds of 75 to 150 feet per minute. Any combination of these speeds can be obtained instantly while the machine is idle or running on either stroke.

The special slow speed is obtained through the back gears on the top and the gear on the left-hand housing. The pinion *E* is keyed fast to the top shaft and engages with the gear *F*, which is keyed to the back-gear shaft with the pinion *G*. This pinion meshes with the gear *H*, which is keyed tight to the hub of the pulley *J*, which is loose on the top shaft. By moving handle *N* the cutting belt is moved from the pulley *A* to *Y*, giving a slow speed to the pulley on the planer, then a further speed reduction is made through the back gears on the left side to the regular gear train in the bed. This gives cutting speeds of 1.6 feet to 3.2 feet per minute.

To change this planer from the slow to the regular speeds, it is only necessary to disengage the back-gear handle *K* and reverse the clutch handle *L*, then shift the belt from the pulley *J* to the pulley *A*, the handle *N* being provided for this purpose. If the planer is going to be used on the regular speeds for any length of time, the back gears *F* and *G* may be disengaged, the handle *M* being provided for this purpose.

This makes a very flexible arrangement, giving cutting speeds from 1.6 feet to 3.2 feet, or from 15 to 54 feet per minute.

The planer was built by the Cincinnati Planer Company, Cincinnati, Ohio.



CINCINNATI SLOW-SPEED PLANER DRIVE

Two Head Automatic Tapper

A two-head automatic tapper has been recently developed by the Garvin Machine Company, New York City, and is known as its No. 1 two-head automatic tapper. The machine works automatically after the tap is once started, and one operator can thus keep the two spindles working all the time.

Each of the spindles is fitted with two friction pulleys, driven in opposite directions by one continuous tensioned belt from an overhead countershaft, between which is a friction clutch keyed to the spindle. This friction clutch is connected with a lever by a toggle arrangement which is adjustable for any drive desired. The spindles are fitted with a positive-drive chuck for holding taps. A screw motion is provided for adjusting the table which has an oil groove all around it. The machine will tap a hole $\frac{1}{16}$ to $\frac{3}{8}$ United States standard tap in cast iron, or $\frac{1}{16}$ to $\frac{1}{4}$ United States standard tap in steel, $1\frac{1}{2}$ inches deep.

A Tap Grinder

In our description of the tap grinder on page 905, mention was not made that while this was built by the Bicknell-Thomas Company it was sold exclusively by the Wells Brothers Company, Greenfield, Mass. In addition, the machine illustrated is also furnished with a bracket for an individual motor, when desired.

Some of the best core-room practice is found in the specialty shops, such as of manufacturers of radiators, pipe fittings, gas-stove burners and automobile engines. In these shops the equipment has been perfected to such an extent that the castings are turned out true to size within limits of a few hundredths or thousandths of an inch, proving that much thought has been spent on the core room and its equipment. But even in the finest and most progressive plants we find conditions which cause loss of time and money. In some plants where the engineers have given painstaking care to the design and construction of the core boxes and core driers, and are using various types of core machines, they are using sands of such a nature that the ingredients of the sand destroy a considerable portion of the oil or other material used as a binder, necessitating an excess of binder, which means unnecessary expense. Most core rooms, also, are hampered by some one condition which is considered a fixture, such as an antiquated oven, a cheap local sand or the prejudice of the foreman in favor of some binding material.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The Geometric Tool Company, New Haven, Conn., is making plans for an additional building.

Work will soon be started on a three-story garage on Crown street, New Haven, Conn., for D. A. Blakeslees and F. S. Woodruff.

D. A. Blakeslee and F. S. Woodruff will build a three-story garage on Crown street, New Haven, Conn.

Plans for a new $50,000 machine shop to be built by the New Haven railroad, at Cedar Hill, have been filed.

The Siro Carbureter Company, Springfield, Mass., manufacturer of carbureters for motorcycles, etc., will move its plant to Adams, Mass., where the Broodley mill has been secured.

The Taunton-New Bedford Copper Company will build a new rolling mill in connection with its plant on North Front street, New Bedford, Mass., doubling present capacity.

The Metz Company, manufacturer of automobiles, will erect a new factory building in addition to its present plant at Waltham, Mass. Considerable new machinery will be required.

The Acme Motor Car Company, Worcester, Mass., has been incorporated with $40,000 capital to conduct an automobile repair plant and garage at 22 Commercial street; president, William Vincent; treasurer, Ernest O. Wheeler.

The Basler Machine Company has been organized at Kittery, Me., to manufacture shoe and leather machinery. Capital, $10,000. Horace Mitchell, president; C. E. Smothers, treasurer.

The A. J. Smart Manufacturing Company, Greenfield, Mass., manufacturer of taps and dies, has purchased the old shoe factory on Hope street, which it will occupy in the near future, giving it increased floor space.

The Waterbury Metal Products Company, Waterbury, Conn., has incorporated with $12,000 capital to engage in the manufacture of metal goods. Incorporators are Frederick A. Goppelt, Jr., John B. Wallace, Jr., and J. M. Burrall.

The Connecticut Metal and Chemical Company, New Britain, Conn., has incorporated with $50,000 capital to engage in a melting and refining business, manufacturing, etc. Incorporators are E. A. Moore, W. S. Rowland and Judge J. E. Cooper.

MIDDLE STATES

The Bloomer (Wis.) Machine Works were damaged by fire.

The Niagara Gasoline Motor Company, Buffalo, N. Y., is erecting an addition.

The Automatic Trip Carrier Company, Rice Lake, Wis., will erect a new factory.

The De Laval Steam Turbine Company, Trenton, N. J., is enlarging its plant.

The Carnegie Steel Company, of Cleveland, Ohio, will erect additions to its present plant.

The American Sheet and Tin Mill Company, Cleveland, Ohio, will erect and equip a large plant.

H. Rechman has let contract for a garage at 215-219 East Gorgas street, Philadelphia, Penn.

The Pyatt Foundry Company, 310-14 North Sangamon street, Chicago, Ill., will build a one-story iron foundry.

The Kelsey Wheel Company, of Detroit, Mich., manufacturer of automobile wheels, is to erect an addition to its factory.

The Pratt & Letchworth Company, manufacturer of castings, at Black Rock, Buffalo, N. Y., is erecting an addition to its plant.

The Carson Trench Machine Tool Company, Rose building, Cleveland, Ohio, will soon erect a large building at Cleveland, Ohio.

Chicago, Milwaukee & St. Paul railroad will build a one-story machine shop at 2915-17 West Chicago avenue, Chicago, Ill., and install new tools.

The Wirt Electric Specialty Company, Philadelphia, Penn., is in the market for a machine for rapid tapping of small malleable pipe fittings.

The foundry and machine shop of the Thompson Iron Works, Black River Falls, Wis., recently destroyed by flood, will probably be rebuilt.

The Buffalo Dehn Company, Buffalo, N. Y., manufacturing wire and sheet-metal ware, will be in the market for wire-bending and forming machines.

The Henderson Motor Cycle Company, of Detroit, Mich., has been incorporated to manufacture motor cycles. T. W. and W. G. Henderson, principal stockholders.

The McCormick branch of the International Harvester Company, will build a one-story addition to its plant at Marshall boulevard and railroad tracks, Chicago, Ill.

The F. B. Stearns Company, of Cleveland, Ohio, manufacturer of Stearns-Knight motor cars, has recently leased a large amount of floor space and will need new equipment.

W. H. Johnson & Son, furnace manufacturers, Indianapolis, Ind., will erect a factory in St. Joseph street, near Fort Wayne avenue. The new building will cost about $14,000.

The Locomotive Equipment Company, of Detroit, Mich., has been incorporated to deal and manufacture equipment for locomotives. C. S. Richards, M. P. Newcomb, stockholders.

The Farrar Iron and Steel Company, West Genesee street, Buffalo, N. Y., expects to remove to larger quarters in the near future and is seeking a suitable location in Buffalo.

Williams-Anderson Machine Company, Chicago, Ill., has been organized with $50,000 capital to do a general machine business, by J. H. Westover, John E. Waters, Eric Wintern.

The Dunlap Manufacturing Company, of Columbus, Ohio, has been incorporated to manufacture pneumatic tools. Machine tools, etc., will be needed. S. M. Dunlap, principal stockholder.

The Krupp Motors Company, Pittsburg, Penn., has incorporated with $250,000 capital to manufacture, sell and deal in vehicles and machines for the generation of steam, electricity, etc.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids November 28, for rivet- and bolt-forging machine for the Norfolk navy yard as per Schedule No. 4069.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 12, for one universal milling machine for the Portsmouth, N. H., navy yard (schedule No. 4103).

The Wheatland mill of the Shenango Iron and Steel Company, Sharon, Penn., recently purchased by Max Solomon, of Pittsburg, Penn., will be put into operation after extensive repairs and improvements.

The H. L. E. Peterson Manufacturing Company, Elgin, Ill., has been incorporated to conduct a general foundry and manufacturing business. Capital, $25,000. Incorporators, H. L. E. Peterson, Albert Fehrman, Julius G. Peterson.

The National Spring Tire Company, Chicago, Ill., has been incorporated to manufacture and deal in automobiles, bicycles, accessories. Capital, $120,000. Incorporators, Chas. L. Sigman, Jr., Louise Valance, Chas. H. Jackson.

The Meteor Automobile Company, Mt. Vernon, N. Y., has been organized with $50,000 capital to manufacture motors, engines, motor vehicles, etc. Incorporators, Frank A. Kateley, 11 Wallace avenue, Albert F. Goscheldt, 154 Cottage avenue, Mt. Vernon, etc.

SOUTHERN STATES

The Virginian railway, Norfolk, Va., will expend $2,000,000 for the construction of new shops at Princeton, W. Va., and for additional equipment.

The Woodward Iron Company, Woodward, Ala., has purchased the properties of the Birmingham Coal and Iron Company, and will expend a large amount of money for improvements.

The United States Cast Iron Pipe and Foundry Company, 71 Broadway, New York, will remodel the Dimmick plant, at North Birmingham, Ala., which it has purchased, and will also make improvements to its Anniston and Bessemer Works, both of Alabama.

WEST OF THE MISSISSIPPI

The Chicago Northwestern road will erect shops at Denison, Iowa.

The south end of the Clinton (Iowa) Bridge Works was destroyed by fire. Loss, $7000.

Cram & Whidden, Lancaster, Cal., will build a new blacksmith shop. Modern equipment will be installed.

Mark Roberts, Juniper street, San Diego, Cal., has taken out a permit to build a commercial garage and repair plant.

The Beatrice (Neb.) Steel Tank Company will remodel the Jonz auto factory for a tank factory. C. S. Warren, secretary.

C. G. Fuller, Eltopia, Wash., will build a machine and blacksmith shop on Fifth street. Modern equipment will be installed.

The Leahy Manufacturing Company, Los Angeles, Cal., manufacturer of oil burners, contemplates the purchase of a turret lathe.

The Drummond Atmospheric Pump Company, Denver, Colo., will erect a plant for the manufacture of a pump invented by W. H. Drummond.

The A. S. O'Neil Company, San Fernando street, Los Angeles, Cal., machinist, has taken out a permit to build an addition to its foundry.

J. C. Meyers, Oakland, Cal., will build a commercial garage and repair plant on Telegraph avenue. A fully equipped machine shop will be installed.

S. C. Haver, Redlands, Cal., has taken out a permit to build a commercial garage and blacksmith shop on West Citrus avenue. Modern equipment will be installed.

The Maricopa (Cal.) Boiler Works will build a new plant in the Fulton district. The present plant will be removed, and the capacity increased. J. R. Williams is head of the company.

Architects Haar & Davis, Central Bank building, Oakland, Cal., are preparing plans for a modern commercial garage and repair plant to be erected in Oakland. The plant is estimated to cost $10,000.

The Ideal Generator Company, Madera, Cal., has been incorporated with a capital stock of $500,000 by G. A. and J. C. Krohn, and A. B. McGilvray, all of Raymond, Cal. The company plans for the erection of a plant for the manufacture of a patented boiler. Modern equipment will be installed.

CANADA

The Gurney Foundry Company, of Toronto, will extend its plant.

Andrews, Bowman & Co. will equip a new garage at 167 King street, Toronto, Ont.

The St. Lawrence Dry Dock and Shipbuilding Company will equip a plant at Quebec.

The Canadian Drawn Steel Company, of Hamilton, will build a big addition to its factory.

The Polson Drydock and Shipbuilding Company, of Toronto, will buy additional equipment.

William Clark & Co., of North Battleford, Sask., Canada, will erect a foundry and machine shop.

The E. C. Atkins Company, of Indianapolis, will locate a Canadian branch of its saw factory at 109 Powell street, Hamilton.

The Laidlaw Bail Tie Company will build a new wire-nail factory at Hamilton, Ont. Electrical machinery will be purchased.

Vickers Sons & Maxim will expend $5,000,000 on a dry dock at Montreal. F. O. Lewis, Bleury street, Montreal, Canadian representative.

The big plant of the American Abell Thresher and Engine Company, at Regina, Sask., was completely destroyed by fire. Loss, $160,000. Will be rebuilt.

Fire destroyed the building occupied by the International Harvester Company, J. A. McIsaac, farm machinery, and R. S. Corbett, engineering supplies, at Woodstock, N. B.

The American Blower Company, of Detroit, Mich., has formed the Canadian Sirocco Company, Ltd., and will locate a plant at Windsor, Ont., for the manufacture of its fans and blowers

The Waterman-Waterbury Company, manufacturing furnaces for heating buildings, has secured a new location in Windsor, Ont., Canada, and will need equipment to take care of its increased business.

GENERAL MANUFACTURING

NEW ENGLAND

Longmeadow, Mass., will erect a pump house in connection with its water system.

The lumber mill of Wilson Googins, Ellsworth, Me., was recently destroyed by fire.

The United States Bobbin and Shuttle Company, Lowell, Mass., will build a new mill.

Fire caused several thousand dollars damage to the Chemical Paper Mill, Holyoke, Mass.

Case & Marshall, East Hartford, Conn., paper manufacturers, will erect a new two-story factory.

The plant of the H. K. Webster Grain Company, Lawrence, Mass., was destroyed by fire. Loss, $25,000.

Work has been started on the new plant of the Gulf Refining Company, in Russell street, New Haven, Conn.

The United Drug Company, of Boston, Mass., is planning to establish a large candy factory in St. Louis.

The saw and finishing mill of Joseph Dagnais, at Fair Haven, Vt., was destroyed by fire. Loss, about $12,000.

Heerdt & Byington are building an addition to their laundry on Bedford place, Stamford, Conn. It will be one story high.

The C. G. Gilman Wagon Company, Worcester, Mass., manufacturer of wagons, will build an addition to its plant at 104 Thomas street.

The Connecticut Agricultural College, Mansfield, Conn., will erect six new buildings, same to be equipped with modern agricultural machinery.

The Bennington Box Paper Company, Bennington, Vt., will erect a new plant for the manufacture of box paper on a site recently acquired in Bennington.

The Tallyho Knitting Company, East Douglas, Mass., will occupy the new two-story factory building to be erected between Depot street and Martin road.

A complete electric-lighting system with an independent power plant, will be installed in the Greylock summer hotel, Williamstown, Mass., in the near future.

The Southern New England Telephone Company will expend about $25,000 for the installation of a new exchange and other improvements at Rockville, Conn.

Samuel F. Scott, proprietor of the Elmdale mill, Uxbridge, Mass., has just completed a new dyehouse which will be equipped with modern machinery throughout.

E. G. Carleton & Son, Rockdale, Mass., manufacturers of silk warp and white flannels, will erect a two-story addition to its plant on Stafford street. New machinery will be required.

The Phœnix Carpet Company, Phœnixville, Conn., will move to Putnam, Conn., where it will locate in the Hammond building. The company manufactures axminster rugs and moves in order to enlarge.

The Chace Manufacturing Company, Boston, Mass., has incorporated with $1,000,000 capital to manufacture yarn, cotton cloth and textile fabrics. Incorporators are George G. Proctor, George M. Faulkner and Emeline M. Bellard.

MIDDLE STATES

John Underwood, of Wausaukee, Wis., will erect a sawmill.

La Crosse, Wis., will build a new $250,000 waterworks system.

The Kismense Silk Mills, at Marshallton, Del., was destroyed by fire.

The Mitchell Cracker plant, at Reading, Penn., was destroyed by fire.

O. L. Silver has let contract for a large brush factory at Clayton, N. J.

J. A. Dietrich, of Cleveland, Ohio, wagon manufacturer, will erect a new shop.

The Victor Milling Company is erecting an addition to its plant at Victor, N. Y.

The Niagara Chocolate Company will build a large factory at Niagara Falls, N. Y.

The Farmers Creamery Association will rebuild its plant recently destroyed by flood.

The Toledo (Ohio) Cap Manufacturing Company will want some power machinery.

The bookbindery plant of C. H. Wornberger, at Pottstown, Penn., was destroyed by fire.

A wagon factory will be erected and equipped by J. A. Dietrich at Cleveland, Ohio.

Owen & Co., of Jefferson, Wis., are planning an erection of addition to their yarn mill.

The Swinehart Tire and Rubber Company, Akron, Ohio, will build an addition to its plant.

The plant of the National Carbon Company, of Lakewood, Ohio, was partially destroyed by fire.

The Standard Furniture Company, Herkimer, N. Y., is building a large addition to its factory.

The Borden Milk Company, of Boston, has purchased a site for a condensary near Granville, N. Y.

The Borham Garment Company, 2901 East Washington street, Indianapolis, Ind., will install a boiler.

The planing mill of John Gable & Son, of Selinsgrove, Penn., was destroyed by fire. Loss, $10,000.

Carl Ball and William Schroeder are building an addition to the latter's blacksmith shop at Merrill, Wis.

The plant of the Philadelphia (Penn.) Manufacturing Company was partly destroyed by fire. Loss, $15,000.

The grinding department of the Watsontown Brick Company, of Watsontown, Penn., was destroyed by fire.

The Oatmen Company, Dundee, Ill., is planning the installation of a milk-condensing plant at Humbird, Wis.

The Hammond Paint and Slugshot Works are erecting an addition to their factory at Fishkill Landing, N. Y.

A. M. Welti & Brothers, Cleveland, Ohio, will build a large dry kiln and will want some woodworking machinery.

The Chicago (Ill.) Flour Mills plant at 4633 Grand avenue, was completely destroyed by fire. Loss, $800,000.

The Heineman Lumber Company is planning to build a plant at Merrill, Wis., which was burned some time ago.

John Immel & Sons, manufacturers of vehicles, Columbus, Ohio, have let contract for an addition to their plant.

The electric-light and power plant at Pulaski, N. Y., will be extensively improved. H. Clayton Burkett, manager.

The plant of the Nicetown Dye Works, of C. and Westmoreland streets, Philadelphia, Penn., was destroyed by fire.

The plant of the Pennsylvania Planing Mill Company, of Reading, Penn., was destroyed by fire. Loss, $30,000.

The grain mill of J. Rosenberg, of 614 to 618 South American street, Philadelphia, was destroyed by fire. Loss, $70,000.

W. J. Black will build a one-story dye house at 6330 Madison avenue, Chicago, Ill., and fit it up with new equipment.

The Cadillac Motor Car Company, of Detroit, Mich., will erect a power house at its new plant which is being erected.

Mitiska & Schnacke, wagon makers and repairers, Evansville, Ind., will erect a new shop at Governor and Columbia streets.

Atlantic Refining Company has let contract for a one-story pump house at Tenth and Sedlegely avenue, Philadelphia, Penn.

The Niagara Textile Company, Lockport, N. Y., is making an addition to its plant to be known as weaving room No. 2.

The American Sales Book Company, Niagara Falls, N. Y., is increasing its plant by construction of an additional building.

The plant of the Woodward Furniture Company, Owosso, Mich., was entirely destroyed by a cyclone. Will be rebuilt at once.

The Blumenstock & Reid Company, Cleveland, Ohio, packing house, will build a tank house and add some power equipment.

The Iroquois Brewing Company is erecting a two-story addition to its plant at Buffalo, N. Y., to be used as a bottling works.

The Astoroga Paper Company, manufacturer of fine tissue paper at Little Falls, N. Y., is erecting an addition to its plant.

The Quaker City flour mills, Thirtieth and Market streets, Philadelphia, Penn., have let contract for a three-story addition to plant.

The Cleveland (Ohio) Electric Railroad Company will build and fully equip a high-tension power plant. John Stanley is manager.

The G. Edwin Smith Company, Columbus, Ohio, has purchased site on Water street, near Spring, and proposes erecting a new shoe factory.

Chas. C. Kelley & Sons Company, Utica, N. Y., has let contract for the erection of a new planing mill at the foot of Meadow street.

The Crystall Creamery Company, Cleveland, Ohio, just incorporated, will be interested in butter-making machinery. G. F. Barton is manager.

The plant of the G. W. Blabon Company, Philadelphia, Penn., manufacturer of oil cloth, was damaged by fire to the extent of $250,000.

The building No. 51 of G. W. Blabon & Co., oil-cloth manufacturers, Nicetown, Philadelphia, Penn., was destroyed by fire. Loss, $400,000.

Fire in the compounding department of the National Conduit and Cable Company's plant at Hastings, N. Y., did damage amounting to about $10,000.

The Breyer Ice Cream Company has let contract for a three-story ice-manufacturing plant at Ninth and Cumberland streets, Philadelphia, Penn.

Fire destroyed the plant of the Huntington (Long Island, N. Y.) Lumber and Coal Company. Loss, about $100,000. The plant will be rebuilt at once.

The Northern Trust Company will build a $150,000 hospital with boiler house and complete power plant at 621 to 639 South Wood-street, Chicago, Ill.

Max Hertz, manufacturer of russet leather, Newark, N. J., will build a large addition to his factory; also new power house and will install new engine and boiler.

Garrett & Son have let contract to rebuild their carriage factory at 3908 to 3918 Spring Garden street, Philadelphia, Penn., to replace the one destroyed by fire.

The Continental Sugar Company has purchased site at Toledo, Ohio, and will erect a $2,000,000 plant. The company operates plants at Fremont and Findlay, Ohio.

Fire following an explosion destroyed the boiler house and power plant of the Lakeview Rose Gardens at Jamestown, N. Y. Loss, $8000. A. N. Broadhead, president.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 12, for one car puller for the Brooklyn navy yard (Schedule No. 4102).

The Shawnee Refrigerator Company, of Xenia, Ohio, has been incorporated to manufacture refrigerators and will need equipment. W. S. Wright, principal stockholder.

The plants of the City Steam Laundry and the furniture plant of the Estey Manufacturing Company, of Owosso, Mich., were totally destroyed by a cyclone. Will be rebuilt at once.

The Valparaiso Specialty Company, Valparaiso, Ind., has been incorporated with a capital of $25,000 by C. F. Specht, M. V. Cheesman and Gus Jones. Will manufacture brooms.

The city of Cleveland, Ohio, will erect a power house at the Cleveland Boys' Home. Full information can be obtained from the office of the director of public safety, F. G. Hogen.

The Fleischmann Company is building a new $30,000 yeast house as an addition to its plant at Peekskill, N. Y., and will erect another large granary in connection with its vinegar plant.

The Doss Folding Window Company, Cleveland, Ohio, has been organized to manufacture folding windows and accessories by Joseph H. Doss, Godfred F. Doss, O. V. Hensley, etc. Capital, $50,000.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids Dec. 12 for one traveling crane for the Pearl Harbor, Hawaii, navy yard as per Schedule No. 4082.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 12, for one surface condenser for the Charleston, S. C., navy yard as per Schedule No. 4083.

Shawnee Refrigeration Company, Xenia, Ohio, has been incorporated with $25,000 capital to manufacture and deal in ice and cold-storage business by W. D. Wright, C. C. Henrie, H. E. Schmidt, etc.

The Krieger Belting Company, New York, has been organized to manufacture leather belting. Capital, $30,000. Incorporators, Ernest Krieger, Albert A. Palmer, 1504 Amsterdam avenue, New York, etc.

The common council of Yonkers, N. Y., has authorized the purchase of a ten-million gallon pump and the construction of two additional filter beds to augment the water supply. The cost is estimated at $175,000.

The Cement Unit Brick and Tile Company has been incorporated at Schenectady, N. Y., with $40,000 capital, Richard E. Emmett, of Schenectady, being president and manager. Work has been started on the plant in Schenectady.

B. F. Crump, formerly associated with the Diamond Mills and American Novelty Company, Saugerties, N. Y., has organized a new concern at that point to manufacture sanitary napkins, table cloths, crepe paper, etc. An abandoned pulp mill in Saugerties is being renovated for the purpose.

SOUTHERN STATES

Arcadia, Fla., will issue $50,000 bonds, part of which will be used for improvements to its water system.

The Kentucky Securities Corporation, Lexington, Ky., will erect a power plant of 5000-kilowatt capacity to cost $400,000.

WEST OF THE MISSISSIPPI

A new pumping station will be built at Portal, N. D.

W. R. Leighton, of Fairbury, Neb., is erecting a modern creamery.

The Poesch Candy Company's factory, at Columbus, Neb., was burned.

The Sherman (Tex.) Ice Company will erect a cold-storage warehouse.

The Quiniault Canning Company will rebuild a plant at Copalis, Wash.

Armour & Co. will erect a $40,000 cold-storage plant at Texarkana, Tex.

A. W. Johnson, of Allison, Iowa, will erect a two-story sash and door factory.

The Blue Valley Creamery Company, of Hastings, Neb., will build an addition.

The Parker mine, Hailey, Ida., will install an electric power system at its properties.

The plant of the Marengo (Iowa) Canning Company was burned. Loss, $37,000.

Western Cooperage Company, of Aberdeen, Wash., will expend $30,000 on improvements.

Wade Herren, Deming, N. M., will install a new pumping plant with a 35-horsepower engine.

J. W. Reveill, of Rochester, Minn., will put up a sawmill at Rogers Spur, near Remer, Minn.

The Schwager & Nettleton Sawmill Company's power plant was burned at Seattle, Wash.

The city of Oxnard, Cal., contemplates the installation of a municipal electric-lighting system.

McKnight & Benjamin, Pecos, Tex., plan for the installation of new pumping machinery.

The Tonopah (Nev.) Mining Company plans for the installation of electric pumping machinery.

Emil Weiss and N. H. Nelson, of Charles City, Iowa, will build an addition to their creamery.

The Nebraska & Arizona Copper Company, Paradise, Ariz., plans to install new hoisting machinery.

The S. & W. Oil Company, McKittrick, Cal., contemplates the installation of oil-drilling machinery.

The Puyallup & Sumner Fruit Growers' Association, at Puyallup, Wash., will enlarge its creamery.

C. L. Gade, of Iowa Falls, Iowa, has commenced the construction of an addition to his gate factory.

Fire completely destroyed the plant of the Imperial Powder Company, at Chehalis, near Olympia, Wash.

The Royal Broom Manufacturing Company, Tacoma, Wash., will establish a broom-manufacturing plant.

The Redlands (Cal.) Paint and Paper Company will make improvements and additions in its shop building.

The Dorrit mine, Idaho Springs, Colo., plans for the installation of an electric power plant. F. L. Patrick is manager.

The printing plant of the Carbon County *News*, Price, Utah, was destroyed by fire. The plant will be rebuilt.

Bonds have been voted and construction work will be rushed on the Spring Valley, Minn., waterworks system.

The creamery plant of T. S. Townsend & Co., Gardiner, Ore., was destroyed by fire. The plant will be rebuilt.

The Portland (Ore.) Gas and Coke Company has taken out a permit to build a pipe-shop addition to its plant.

The lumber-mill plant of the Fern Lumber Company, Frances, Wash., was destroyed by fire, with a loss of $50,000.

The Conconully (Wash.) Electric Light Company will install new boiler equipment. J. D. Morton is superintendent.

Hunt, Hatch & Co., Lindsay, Cal., will increase the capacity of its fruit-packing plant. New machinery will be installed.

The Glacier (Wash.) Development Company plans for the erection of an aërial tramway about four miles in length.

The city of Twisp, Wash., plans for the installation of a waterworks plant and system. The city council is in charge.

The Central Milk Company, San Francisco, Cal., has taken out a permit to build a modern creamery plant on Tehama street.

C. A. Clement, Seattle, Wash., will establish a modern steam-laundry plant on Fifth avenue. The plant will be fully equipped.

The Bellingham (Wash.) Canning Company (fish) plans for the erection of a new plant. Modern machinery will be installed.

The city of Seattle, Wash., will make improvements and extensions in its municipal lighting plant and system to cost $1,000,000.

The powder-manufacturing plant of the Trojan Powder Works, San Lorenzo, Cal., was destroyed by fire. The plant will be rebuilt.

The Seattle (Wash.) Lighting Company plans for the erection of a gas plant and system, near Seattle. A franchise has been asked.

The Union Ice Company, San Francisco, Cal., has taken out a permit to make improvements and additions in its plant on Howard street.

The Standard Engraving and Cut Glass Company, of Minneapolis, Minn., plans upon putting up a cut-glass factory at Rochester, Minn.

The Atlas Wonder Mining Company, Wonder, Nev., plans to install new electric hoisting machinery. E. S. Cunningham is in charge.

W. I. Clark, Dorris, Cal., plans for the erection of a sash- and door-manufacturing plant. Modern woodworking machinery will be installed.

The Hazleton-Cairney Company, Monroe, Wash., plans for the erection of a grain-milling plant. Modern machinery will be installed.

The Iron Mountain mine, near Wallace, Ida., plans for the erection of an electric power plant. About $100,000 will be expended.

The Fortuna (Cal.) Water Company plans to install new pumping machinery. F. A. Leach and L. C. Morgan are interested in this company.

The Eagle Milling Company, Tucson, Ariz., plans for the erection of a flour-milling plant at Safford, Ariz. Modern machinery will be installed.

The Minor County Milling and Lighting Company, Howard, S. D., is erecting a boiler room and will install a new boiler at Howard, S. D.

The lumber plant of the Miller & Lux Company, San Francisco, Cal., at Newman, Cal., was destroyed by fire. Loss estimated at $35,000.

The Pomona (Cal.) Fruit Growers' Exchange plans for the installation of a precooling plant in its fruit-packing house on West Bertie street.

The Acme Coöperative Brick and Tile Company, of Webster City, Iowa, is planning the erection of a plant, three stories, 350x200, to cost $500,000.

The Socialist Bulletin Printing Company, Bakersfield, Cal., plans for the erection of a modern printing plant. I. T. Sharp is head of the company.

The Larson (Wash.) Lumber Company, near Bellingham, will rebuild its lumber mill and sawmill plant on Lake Whatcom, recently destroyed by fire.

The Pacific Light and Power Corporation, Los Angeles, Cal., has taken out a permit to make improvements in its power plant on East Third street.

The Central California Canneries Company, Yuba City, Cal., plans to increase the capacity of its fruit-canning plant. New machinery will be installed.

The Livermore (Cal.) Water and Power Company plans for the extension of its electric-lighting and power system from Pleasanton to Sunol, Cal.

The Abernathy Heights Company, Portland, Ore., plans for the installation of a waterworks system in the Abernathy Heights district, near Riverview.

The Northwest Blaugas Company, manufacturer of liquid gas, has started the erection of its $100,000 plant in the midway district, St. Paul, Minn.

The city of Prosser, Wash., plans for the installation of a modern waterworks system. About $48,000 will be expended. City Engineer Walter is in charge.

The Tacoma (Wash.) Investment Company contemplates the installation of an electric-lighting plant at Castlerock, Wash. A franchise has been granted.

The Union Ice Company, Los Angeles, Cal., has acquired property on Santa Monica avenue, and plans for the erection of a 50-ton ice-manufacturing plant.

W. Darling, Bakersfield, Cal., plans for the erection of a plant for the manufacture of brooms and kindred specialties. Modern machinery will be installed.

The Culdesac Creamery Company, Culdesac, Ida., has been incorporated and plans for the erection of a modern creamery plant. The plant will be fully equipped.

Hepburn Brothers, Los Angeles, Cal., manufacturers of window screens, doors and lumber specialties, have taken out a permit to build an addition to their plant.

The Falls City (Ore.) Lumber Company plans for the removal of its lumber mill plant No. 1 from near Albany to Falls City. The new plant will be fully equipped.

The Miller Brothers, Eugene, Ore., plan for the erection of an electric power plant on the Siuslaw river, near Mapleton, Ore. Geo. M. Miller, Eugene, is interested.

The Barber Asphalt Paving Company, Los Angeles, Cal., has taken out a permit to make improvements and additions in its manufacturing plant on Alhambra avenue.

The meat-packing plant and ice plant of the Grand Ronde Packing Company, La Grande, Ore., was destroyed by fire. Loss, $16,000. The plant will be rebuilt.

The Pacific Navigation Company, San Pedro (Los Angeles), Cal., has taken out a permit to build a laundry plant and boiler room. Modern equipment will be installed.

The Pacific Telephone and Telegraph Company, Portland, Ore., plans for the installation of a telephone system at Harrisburg, Ore. A franchise has been requested.

The Vallejo (Cal.) Electric Light and Power Company plans for the installation of a lighting and power system in the O'Hara district. Albert Casper is manager.

The Los Angeles (Cal.) Investment Company has taken out a permit to erect a new boiler room and dry-kiln addition to its lumber-working plant on Slauson avenue.

The electric power plant of the Schwager & Nettleton Lumber Mill Company, Seattle, Wash., was destroyed by fire. Loss, estimated at $25,000. The plant will be rebuilt.

The Idaho Realty, Power and Mines Company, Dixie, Ida., plans for the erection of a modern electric power plant for mines operation. S. R. Gayton is general manager.

The Lemhi Telephone Company, Salmon City, Ida., contemplates the construction of a system along the Lemhi river. W. A. McCutcheon is interested in this company.

The Eagle Brewing Company, San Francisco, Cal., has taken out a permit to erect a new brewing plant on Mission aveue, to replace its plant recently destroyed by fire.

The Reno (Nev.) Power, Light and Water Company has been ordered by the Nevada Public Service Commission to make improvements and additions in its waterworks system.

A cold-storage plant will be erected in connection with the new warehouse to be established by William E. Hampton, Los Angeles, Cal., on Mill street. Plans are being prepared.

The Des Moines (Iowa) City Railway Company is making improvements to its power plant, which will cost $150,000. New turbine and coal-handling apparatus will be installed.

Fulton & Woodley, San Pedro (Los Angeles), Cal., have taken out a permit to erect a boat-building and repair plant on Mormon island. Modern machinery will be installed.

The lumber-mill plant of the Northwestern Lumber Company, Kalispell, Mont., recently destroyed by fire with a loss of about $100,000, will be rebuilt. C. L. Dobner is president.

The Delano (Cal.) Linns Valley Telephone Company, recently incorporated, plans for the installation of a plant and system near Delano. Benjamin Thomas is head of this company.

The Southern Pacific Railroad Company is said to be planning for the erection of an electric power substation at Melrose terminal, Oakland, Cal. The cost is estimated at $30,000.

The Portland (Ore.) Artificial Ice Company has had plans prepared for a new ice-manufacturing and cold-storage plant to be erected on Eighteenth street. About $20,000 will be expended.

The Belingham (Wash.) & Skagit County Interurban Railway Company plans for the establishment of an electric-light and power plant at Woolley, Wash. A franchise has been asked.

The city of Seattle, Wash., has taken out a permit to build a refuse and garbage-disposal plant on Wallingford avenue. About $50,000 will be expended. Modern equipment will be installed.

The Pacific Gas and Electric Company, San Francisco, Cal., has commenced the erection of its proposed 5000-kilowatt steam-generating plant at Sacramento, Cl. The plant will be fully equipped.

The city of Tacoma, Wash., contemplates the installation of an electric tramway system at the municipal Nisqually power plant. About $18,000 will be expended. Engineer Gronen is in charge.

The Fire Commission, Los Angeles, Cal., will install a private telphone plant and system at San Pedro harbor. The superintendent of the bureau of fire alarm and police telegraph is in charge.

The Pacific Coast Planing Mill Company, Los Angeles, Cal., contemplates the erection of a new woodworking plant. About $150,000 will be expended. W. E. Hampton is president of this company.

The city of Ellensburg, Wash., plans for the installation of a modern waterworks plant.

About $150,000 will be expended. Samuel Kreidel, of the city water commission, is interested in this work.

The Marek & Weberm Company, Colfax, Wash., plans for the erection of a meat-packing plant and cold-storage plant. A fertilizer plant will also be erected. Modern equipment will be installed.

The lumber plant of the Chehalis (Wash.) Lumber Company, at Littell, Wash., recently destroyed by fire, will be rebuilt. New sawmill and planing mill will be erected. Benjamin Moore is manager.

The Fort Worth & Southwestern railroad, Fort Worth, Texas, has incorporated with $400,000 capital to construct and operate a railroad from Fort Worth to Eagle Pass. Incorporators are W. D. Morton, I. A. Wright, J. H. Farr and others.

The Flathead Independent Telephone Company, Hamilton, Mont., recently incorporated, plans for the installation of a plant and system in Flathead county. A. H. Stephens is interested in this company.

The Pacific Power and Light Company, Portland, Ore., will build a number of substations, and switching stations near Pasco, Wash. About $80,000 will be expended. James H. Moore is in charge.

The Milwaukee Power Company, Libby, Mont., plans for the erection of a power plant at Yakt Falls, with a generating capacity of 3400 horsepower. J. H. Ehlers is interested in this company.

The Lost Hills Telephone and Telegraph Company, Bakersfield, Cal., plans for additions and improvements in the Lost Hills district. About $25,000 will be expended. Richard Hastings is general manager.

The American Steel and Wire Company, Sixteenth street, San Francisco, Cal., is having plans prepared by its engineering department for a modern pumping station. About $75,000 will be expended on this work.

The Etna Cement Plaster Company, San Fernando building, Los Angeles, Cal., recently incorporated, plans for the erection of a large plaster-manufacturing plant in southern Nevada. Thomas Mahoney is manager.

The American Beet Sugar Company, Oxnard, Cal., will build an addition to its sugar-manufacturing plant at Chino, Cal. The capacity will be increased and new machinery installed. About $135,000 will be expended.

The Wilbur Reclamation Company, Hanford, Cal., contemplates the installation of pumping plants and irrigation system, near Tulare lake. About $50,000 will be expended. W. H. Wilbur, Alpaugh, Cal., is head of this company.

The Central Oregon Power Company, Baker, Ore., recently incorporated, plans for the installation of a number of electric pumping plants in connection with its irrigation works system. W. A. Pope is head of this company.

The Stanley (N. M.) Coöperative Creamery, recently organized, plans for the erection of a modern creamery plant. A pumping plant will also be installed. The plant will be fully equipped. J. M. Reeves is head of the company.

H. C. Peterson, Junction, Ore., is at the head of a coöperative company which plans for the erection of a modern creamery plant. A refrigerating plant will be installed in connection. Electrically operated machinery will be installed.

The Inspiration Copper Company, Globe, Ariz., is planning for the installation of a private telephone system from Pinal creek to its mines, a distance of 18 miles. F. J. Brule and H. J. Wallace will be in charge of this work.

Engineer James E. Barker, Los Angeles, Cal., engaged by the city of Phœnix, Ariz., to report on electric-lighting conditions of the city, has recommended the establishment of a municipal lighting plant. The city council is interested.

The W. H. Blumenstein Chemical Works, Pottsville, Penn., contemplates the erection of a plant at Anacortes, Wash., for the manufacture of powder and explosive specialties. F. D. McCullough, Seattle, Wash., is local representative.

The Idaho-Oregon Power Company, Boise, Ida., contemplates the installation of an electric-light and power system at Vale, Ore. The company also plans for the construction of a system between Boise and Weiser, Ida., by way of Nyssa, Ore.

The Montesano (Wash.) Light and Power Company will build a new electric power plant. Contract for turbine and generators has been awarded. The plant will be fully equipped with necessary auxiliaries. T. H. Minear is in charge.

The Oro Electric Corporation, Oroville, Cal., plans for the erection of a large electric power plant on the Feather river. A power-transmission system will be constructed to Oroville, Marysville and Sacramento. James W. Goodwin is president.

M. J. Anderson, Grants Pass, Ore., plans for the erection of an electric power plant on the Coquille river, Coos county. A power-transmission system will be constructed to serve the surrounding territory. The work is estimated to cost $1,000,000.

The Scanlon-Gipson Lumber Company, Minneapolis, Minn., plans for the erection of a lumber-manufacturing plant at Bend, Ore., with a daily capacity of 300,000 feet per day. The plant will be thoroughly modern. Henry E. Gipson is head of this company.

The Libby, McNeill & Libby Company, Chicago, Ill., fruit and meat packers, has acquired a site on Nelson Lagoon, Alaska, and plans for the erection of a fish-canning plant with a capacity of 200,000 cases per season. The plant will be fully equipped.

In connection with the new mining building to be erected by the Oregon Agricultural College, Corvallis, Ore., there will be installed large drafting rooms, assay and metallurgical laboratories, and geological laboratory. The plant will be fully equipped throughout.

Power-plant equipment will be installed in the new Whitman school to be erected in Cannondale, Spokane, Wash. The structure is estimated to cost $75,000. Robert C. Sweatt, architect, Spokane, is preparing plans. Manual training machinery will also be installed.

The powder-manufacturing plant of the Imperial Powder Company, Chehalis, Wash., was completely destroyed by fire. The plant will be rebuilt, and the capacity doubled. The company also plans for the erection of powder-manufacturing plants at Medford, Ore., and near Reno, Nev. G. C. Israel is secretary.

The Pacific Light and Power Corporation, Los Angeles, Cal., has voted a bond issue of $35,000,000 for the construction of its proposed power plant at Big Creek, San Joaquin valley, and for extensions and improvements in its power and lighting system in the vicinity of Los Angeles.

The Long Valley Light and Power Company, Wallace, Ida., has been incorporated with a capital stock of $100,000. The company plans for the erection of a power plant on the Payette river of 4375 horsepower. Electric-lighting systems will be installed at Van Wyck, McCall, Lardo, Rosebury and other places. Waterworks, with electric pumping machinery, will also be constructed. Walter C. Clark, of the Bunker Hill & Sullivan Mining Company, Wardner, Ida., is president.

CANADA

Midland, Ont., will buy equipment for a water and light plant.

Coleman, Alta., will expend $65,000 on a new waterworks system.

The McKellar Shoe Company will locate a new plant at Berlin, Ont.

Robert Smith will equip a sash and door factory at Southampton, Ont.

Moosejaw, Sask., will expend $17,000 extending its fire-alarm system.

The Renfrew Lumber Company will equip a big new mill at Hope, B. C.

The Canada Cement Company will double its plant at Port Colborne, Ont.

The Toronto Electric Light Company will equip a new transformer station.

The Canadian Knitting Company will build a new factory at Hamilton, Ont.

Hamilton, Ont., will purchase two electric pumps for a sewage-disposal plant.

Drummondville, Que., will purchase machinery for generating electric power.

Vancouver, B. C., will equip a municipal asphalt plant. F. Fellowes, engineer.

The Pelham Canning Company will equip a large canning factory at Ridgeville, Ont.

The Western Tent and Mattress Company will build a new factory at Calgary, Alta.

The Buffalo Smelting Company will equip a new $200,000 plant at Port Colborne, Ont.

The White Pine Lumber Company's mill was burned at Blind River, Ont. Loss, $150,000.

The Toronto Niagara Power Company will make extensions to its power plant at Niagara Falls, Ont.

The Ontario Power Company will spend $200,000 on new equipment shortly, at Napanee, Ont.

The Nicola Valley Meat Company, Merritt, B. C., will build a new cold-storage plant to cost $15,000.

The Wallaceburg Window Glass Company will locate a new $125,000 factory at Wallaceburg, Ont.

The Canadian Puget Sound Lumber Company, of Victoria, B. C., will make extensions to its plant.

Berlin, Ont., will equip a new waterworks pumping station and extend its system. Electric pumps required.

The plants of the *Evening News* and Standard Printing Company were completely wiped out by fire at New Glasgow, N. S.

The Blovedel Stewart & Welsh Company, Ltd., will equip an immense saw mill at Myrtle Point. Head office, Winch building, Vancouver, B. C.

FOREIGN

The Chapala Hydroelectric and Irrigation Company, Puente Grande, Jalisco, Mex., plans to rebuild its power distributing system. New equipment will be required. The company also plans for the installation of lighting and power systems in the Etzatlan and Hostotipaquillo mining districts.

MINING

The Kennedy mine, Buckskin, Nev., plans for the construction of a concentrating plant.

The Ernestine Mining Company, Mogollon, N. M., will increase the capacity of its stamp mill.

The El Carmen mine, Parral district, Mex., will erect a large milling plant. F. C. Alley is manager.

The Commonwealth Mining Company, Pearce, Ariz., plans for the erection of a 300-ton milling plant.

The Mayfield mine, near Valdez, Alaska, contemplates the erection of a mill. M. M. Reese is head of this property.

The Jo Dandy mine, Cripple Creek, Colo., plans to double the capacity of its stamp mill. Thomas Kavanaugh is manager.

The Rexall mine, near Fairbanks, Alaska, plans for the erection of a milling plant. Cooper & Stillman operate this property.

The C. O. D. Consolidated Mining Company, Goldfield, Nev., contemplates the erection of a milling plant. L. K. Koontz is manager.

J. D. Campbell, Los Angeles, Cal. (care of B. F. Taylor), plans for the installation of gold-dredging and mining machinery at Teller, Alaska.

The Nevada Consolidated Mines Company, Reno, Nev., plans for the erection of a concentrating plant. Edwin Arkell is general manager.

The Republic (Wash.) Mines Company contemplates the enlargement of its milling plant. New machinery will be installed. J. L. Harper is manager.

The Nelson mines, French Gulch, near Virginia City, Mont., plan for the erection of a milling plant. Parkinson & Stranaham operate this property.

The Float Gold Amalgamated Company, operating on the Santa Cruz River, near Nogales, Ariz., will install a 50-ton cyanide plant. John Kunny is manager.

The Lucky mine, Grass Valley district, Cal., operated by the Union Hill Mining Company, contemplates increasing the capacity of its stamp mill. New equipment will be installed.

The Davis Mining Company, operating near Stillwater, Cal., plans for the erection of a reduction plant. About $40,000 will be expended. Edward Shoeraff is interested in this company.

The Sierra Consolidated Mining Company, Ocampo district, Chihuahua, Mex., plans for the erection of a 40-stamp mill. The company maintains offices at Duluth, Minn.; J. P. Cotton is president.

The Ima Consolidated Mining Company, Salmon, Ida., plans to increase the capacity of its milling plant. New machinery will be installed. C. H. Hussy, Ogden, Utah, is interested in this company.

The concentrating plant of the Butte (Mont.) Reduction Works was destroyed by fire with a loss of $250,000. The machinery loss is estimated at $140,000. The Anaconda Copper Mining Company operates this property.

The Giroux Consolidated Mining Company, Ely, Nev., is having plans prepared for increasing its concentrating plant at Kimberly, Nev., from 500 to 1200 tons daily. Consulting Engineer Snedeker is in charge. T. F. Cole is president.

The American Metals Mines Company, Cedar, Ariz., recently organized, plans for the erection of a milling plant on its properties in the Bonanza Basin district. New hoisting machinery will also be purchased. J. W. Cornelius is head of the company.

Business Items

The drilling and tapping machines and radial drills exhibited at the International Exposition, Turin, Italy, by the Cincinnati Bickford Tool Company were awarded the "Grand Prix."

The H. V. Lewis Company, 30 Church street, New York City, has been formed to act as selling agents in the Philadelphia and New York territory. H. V. Lewis, president; Geo. C. Hughes, vice-president; Arthur H. Vallquette, secretary and treasurer.

Catalogs Wanted

The Brown & Zortmann Machinery Company, machine tool and supply agents, are moving into new building at 2545 Liberty avenue, Pittsburg, Penn., and would like latest catalogs from manufacturers of machine tools and supplies.

Forthcoming Meetings

American Society of Mechanical Engineers, annual meeting, December 5 to 8, New York City. Calvin W. Rice, secretary, Engineering Societies building.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, Amer. Machinist.

Wanted—Screw machine work; send blueprints or samples for quotations. Remington Mfg. Co., Fitchburg, Mass.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Well established concern would consider manufacturing a small patented machine on royalty. Box 1372, New Haven, Conn.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

Tubing, steel or iron; want 100,000 feet, lap weld, 1½ inches outside diameter, 0.065 approximately, random or short lengths or seamless drawn, seconds, or oxyacetylene butt weld; information desired about low price steel tubing lighter than gas pipe. Box 591, American Machinist.

Wanted—To communicate with manufacturer having foundry or drop forge with machine shop facilities, wishing to add a wrench and a pipe cutter to his lines; established trade, dies and tools, etc., can be turned over with reasonable business arrangement to proper party. Address "Coöperation," Am. M.

Mechanical draftsman and designer of machinery desires to correspond with concerns or private parties who have work from time to time along the line of designing machinery tools, etc., detailing, tracings, engineering plans or patent office drawings; call or write. S. Kahn, 158 East 60th St., New York City.

Wanted—Special machinery for motor truck construction; a company about to manufacture motor trucks on a large scale wishes to obtain catalogs from all makers of special machinery for gas engine and motor truck work. Address Box 583, American Machinist, and if interested will send for your catalogs and representatives.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CALIFORNIA

Wanted—On the Pacific coast, first-class toolmakers for experimental work; special tools, dies, etc., for small work in the typewriter class. Box 522, Amer. Machinist.

CONNECTICUT

Experienced Jones & Lamson operator; must be quick on setting up and accurate; give references and state wages. Box 594, American Machinist.

An eastern corporation manufacturing tools desires to engage a capable young man who has backbone, to call upon railroad companies, manufacturers of machinery, agricultural implements, etc.; one who has it in him to see the practical man of the concern and get his specifications to be executed through his dealer; this is an exceptional opportunity for advancement if advancement is merited; state age, experience and where at present employed. Address "K. S. B.," Amer. Mach.

MARYLAND

Wanted—High-grade toolmakers accustomed to jigs and dies. The Universal Telegraphic Company, Baltimore, Md.

MASSACHUSETTS

Wanted—Machinist and instrument maker for physical laboratory; must know all parts of machinists' trade, tool and pattern making. Apply, stating experience, age, present wages, to Prof. A. G. Webster, Clark University, Worcester, Mass. German or Swiss preferred; language no object; moderate pay, but good place for competent man. Box 585, AMERICAN MACHINIST.

MICHIGAN

Wanted—By automobile company near Detroit, a man for setting time on all machine shop jobs; must be all-round man capable of proving time said to be correct; state age, experience, salary expected, when available and references. Box 603, AMER. MACHINIST.

MISSOURI

Wanted—Superintendent who can invest $2000 to $3000; five-year contract. Suite 616, Commerce building, Kansas City, Mo.

NEW JERSEY

Wanted—Experienced operator on Ingersoll two spindle vertical milling machine. Box 606, AMERICAN MACHINIST.

Draftsmen—Competent men with broad experience in mill-building construction, power plant design and general engineering, wanted at once by large industrial plant near New York City; full particulars as to experience, age, salary and references required. Box 596, AMERICAN MACHINIST.

NEW YORK

Wanted—Experienced foreman for scale beam room in large scale factory; high wages to the right man. Box 595, AMER. MACH.

Draftsman, accustomed to work under instruction, who has had experience in machine tool factories and whose work is accurate; state salary expected. Box 604, AM. MACH.

Wanted—First-class draftsman on tool, jig and fixture work for machine shop doing medium weight line of high-grade work. Box 608, AMERICAN MACHINIST.

Wanted—Chief draftsman acquainted with crane and hoist construction; one who can give positive evidence of ability, can secure permanent and satisfactory position. Address Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Lathe demonstrator to operate lathes in the shops of customers; must be of forceful character with much tact and a thoroughly good lathe hand; preferably unmarried; must be willing to travel; a desirable permanent position for the right man. Box 578, AM. MA.

Tool Designers—Experts on punches and dies; only top notchers capable of earning big money need apply; a first-class proposition for the right kind of man; work in New York City. Write, stating age, nationality, experience and salary expected. Box 592, AM. MA.

A superintendent of good business ability, who is familiar with modern machine shop practice; understands scientific management and who is capable of planning and executing factory work with the best economy; state age, experience and salary expected. Address "Economy," AMERICAN MACHINIST.

Draftsmen—Thoroughly familiar with machine shop practice on small interchangeable parts of electrical apparatus; position only for first-class men capable of earning the top market price; no others need apply. Write, stating age, nationality, experience and salary expected. Box 593, AMER. MACHINIST.

Applications wanted from young men who have had factory office experience, preferably in motor vehicle industry, to fill vacancy requiring ability to accurately compile estimates of costs of production; apply in own handwriting and state age, nationality, experience in detail and salary expected. "W. S.," Box 565, AMERICAN MACHINIST.

Large concern, manufacturing electrical specialties, located in the southern part of Germany, wants technical graduate to assist general manager; must be able to handle fully, German and English correspondence, and must have a good technical and general business experience; applicants experienced in automobile line preferred; send photograph and give detailed report of business experience, references, age, nationality and salary expected. Address reply to Bosch Magneto Company, office of the president, 223 W. Forty-sixth St., New York City.

OHIO

Wanted—Designer and draftsman who is thoroughly familiar with presses, shears and special machinery. Box 561, AMER. MACH.

Agents wanted in every shop for a new popular magazine on mechanical progress; is a winner; make a handful by getting at work now. E. D. Leslie, Caxton Bldg., Cleveland, O.

Wanted—Machine shop foreman; medium and heavy work; seventy-five to one hundred men; must have good judgment, be acquainted with best modern shop practice, and be able to reduce costs; state age, references and salary; permanent. Box 597, AM. MACH.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

FOREIGN

Hungary, a rising market for machine tools and tools needs a local agent for efficient trading; a Budapest firm of high repute is open to take up a few first-class American agencies; references exchanged. Box 513, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Temperer and hardener, fifteen years' experience. Box 599, AMERICAN MACHINIST.

ILLINOIS

Punch and die designer, experienced on typewriter and adding machine work, wants responsible position, shop or drafting room. Box 609, AMERICAN MACHINIST.

INDIANA

Salesman machine tools, experienced; thorough mechanic, familiar with uptodate practice; young, of good address, aggressive; milling machines, grinder or automatic machinery preferred; best references as to loyalty and ability. Box 575, AMER. MACH.

Manager wants position; ten years' experience in sheet metal stamping business; good executive and finished correspondent; cost and production expert; thoroughly familiar with modern office and shop methods, labor problems, etc.; thirty-five years of age and married; capable, steady and a hustler. Box 590, AMERICAN MACHINIST.

IOWA

Student, three years' mechanical drafting, wants actual drafting room experience; wages not so much of an object as permanent position with good chance for advancement; not particular about location; good references. Address "Experience," care AMER. MACH.

MASSACHUSETTS

Superintendent, energetic, practical, a good organizer, can reduce costs and show results, medium and light machinery and mechanical devices. Box 587, AMERICAN MACHINIST.

Young man, experienced in the designing and detailing of special automatic machinery, desires to change his position; will accept a good proposition. Box 598, AMER. MACH.

MICHIGAN

Wanted—Position as general superintendent or works manager; applicant is 37 years old and has had a successful career building steam turbines, steam engines and automobiles; is an expert on systematizing and getting highest production with minimum labor cost; let me help you to bring that plant of yours up to its maximum efficiency. Address I. E. Hindman, 152 Englewood Ave., Detroit, Michigan.

NEW JERSEY

Position wanted by a first-class tool designer, now employed, but desires change. Box 584, AMERICAN MACHINIST.

Accomplished hydraulic machine-shop foreman desires change; thoroughly familiar with uptodate practice; executive ability. Box 588, AMERICAN MACHINIST.

General machine-shop foreman desires change; thoroughly conversant with modern factory methods, executive ability; excellent record. Box 589, AMER. MACHINIST.

NEW YORK

Experienced designer of Diesel oil engines desires position. Box 557, AMER. MACH.

Mechanical draftsman, with various experience, wishes position. Box 607, AM. MACH.

Factory appraisal my specialty, ten years; finish this job November 20. Box 555, AM. M.

Draftsman, special automatic machinery, desires position near New York; nine years' experience. Box 601, AMER. MACHINIST.

Mechanical engineer having shop and office experience, is open for job in metropolitan district. Box 576, AMERICAN MACHINIST.

Mechanical engineer, age 32, with excellent experience and record, wishes position as mill superintendent or business manager. Box 506, AMERICAN MACHINIST.

Expert in machine shop office work, cost keeping, systematizing, buying and selling; would possibly prefer to increase my experience in selling in a new position. Box 611, AMERICAN MACHINIST.

Practical engineer, 30, with 12 years' experience as designer, inspector and assistant superintendent, wishes position as shop engineer or assistant superintendent with plant having foundry or one where foundry experience would be of value. Box 605, AM. MACH.

Mechanical engineer, College Berlin, Germany, 10 years machinist, designer, estimator, assistant of manager, with A-1 automatic tool and special machine concerns, desires a change; expert cost reducer; can handle men; best references; location, immaterial. Box 602, AMERICAN MACHINIST.

OHIO

Designing draftsman and estimator, specialized on safe, vault and steel plate work; can write specifications and handle general office and factory duties; East preferred. Box 600, AMERICAN MACHINIST.

First-clas mechanical designer at present holding good position, experienced on small intricate design, and capable of designing tools for same, desires position East. Box 586, AMERICAN MACHINIST.

Business executive or engineer; mechanical engineer, technical graduate, ten years' business and engineering experience; practical, progressive and inventive; consider position in Middle West. Box 562, AMER. MACHINIST.

A tool and machine designer with shop, office and selling experience; specialty, firearm, typewriter and computing machine work; well up on modern manufacturing methods; good executive ability; have a clean record; wishes to make a change where there will be greater opportunities for advancement. Box 4, Dayton, Ohio.

PENNSYLVANIA

Experienced tool and machine designer wants position near New York. Box 483, AMERICAN MACHINIST.

RHODE ISLAND

Competent mechanical engineer, graduate, five years' experience, open for engagement January 1; good systematizer; able executive and superintendent. Box 577, AM. MACH.

WISCONSIN

Position wanted with gas engine firm that wishes to add to their personnel, a man of wide experience among large gas engine manufacturers, who could act as chief engineer, superintendent, or assistant manager; has held responsible positions with the oldest and largest gas engine manufacturers in the country; thoroughly uptodate, highest technical education; age 32; location immaterial. Box 610, AMERICAN MACHINIST.

FOR SALE

For Sale — 175-horsepower, 450-volt, 60-cycle, 3-phase, General Electric motor, direct connected to 56¼-kilowatt, 220 compound-wound, Westinghouse generator; A-1 condition. Box 612, AMERICAN MACHINIST.

For Sale—$15,000 worth of stock in first-class foundry and machine shop working about 20 men and doing from $2000 to $4000 worth of business per month; incorporated for $25,000, for 50 cents on the dollar. Shop located in Florida; good reason for selling. Answer if you mean business. Address "M.," Care AMERICAN MACHINIST.

Stock for Sale—Controlling interest in the Fishkill Landing Machine Company, builders of the "Fishkill Corliss" engines; iron and brass castings, shafting, pulleys and gearing; business long established, having an enviable reputation for its high-class work; the works are located on the east bank of the Hudson river, fifty-eight miles above New York City, and about three minutes' walk north from the Fishkill Landing station of the New York Central and Hudson River railroad, a track of which runs through the works; also connected with the following railroads: West Shore; Erie; New York, Ontario & Western; New York, New Haven & Hartford; Newburgh, Dutchess and Connecticut. These connections, in addition to the extensive dock frontage, afford unsurpassed facilities for receiving and shipping by rail or water; no better location can be found in New York State for manufacturing purposes. This is a rare opportunity to purchase a large share of a concern which is favorably known throughout the country. For particulars, address W. F. Sage, Fishkill-on-Hudson, New York.

Talks With Our Readers

By The Sales Manager

Graham Hood, who writes the little stories of practical, every-day philosophy for the New York *Evening Globe*, recently published one on the importance of a man's equipping himself with the right knowledge and training, in the right way, and at the right time in his career.

To quote a part of it:

"If there is anything that it is absolutely necessary that you should know, especially in your business life, there is every probability that you will in some way manage to acquire this information some time. If you are wise you will go about the work of acquiring this knowledge systematically, beginning at the earliest possible moment.

"Because you fail to do this, however, don't imagine for a moment that you are to go through life in the state of ignorance that you have adopted.

"Even though you might be so foolish as to deliberately elect to know nothing that might help you get on in the world, you can't keep yourself from gaining this knowledge, for the only way to escape the lessons that Schoolmaster Experience teaches is to stop living. As long as breath remains in our bodies we are compelled to continue our studies in this school.

"The mistake that a great many persons make, however, is that of waiting until the knowledge comes to them instead of going after it. It may be true that the knowledge may come eventually, but what are to become of the countless opportunities when the sometime-to-be-acquired knowledge would enable you to change a failure into a successful achievement?

"It is true that it costs something to secure this knowledge at first hand. It costs a great deal of time, much patience and persistence, and possibly a little money, but if you could compare the cost of the knowledge you get in this way, and that for which you have to wait until experience can get a chance to teach you, you would be amazed to see how much cheaper it is to secure your training in the right way.

"In the first place, the man who knows just what he wants to do, and exactly how he should go to work to get these results, reduces the possibility of mistakes and failure to a minimum. Mishaps may occur, for it is not easy to devise a positive safeguard against such incidents, but should they happen the man who knows how can usually find an easy way to remedy them.

"It is the fellow who does not know, and who is waiting for experience to teach him, who falls into all sorts of costly pitfalls. Experience does teach him in time, but in the meanwhile he must meet the cost of his experiments, and the expense of tuition in the School of Experience is far in excess of that which is charged for the thorough training that he may so easily secure at the beginning of his career."

The moral is, don't wait until knowledge comes to you—go after it.

It is the AMERICAN MACHINIST'S business to bring you a fund of valuable knowledge each week—all you need to do is to go after it, to read it. The selling section of this paper represents in reality an enormous, costly system of engineering education, which comes to you every week.

If you don't conscientiously read and study the ads. you are neglecting a great opportunity.

The information is there—go after it.

* * *

Only reliable products can be continuously advertised.

Tools for Building Universal Grinders

By F. A. Stanley

Jigs and fixtures for drilling and boring bases, gear boxes, wheel stands, plates and other parts; milling fixtures for machining brackets, boxes, racks and back rests.

A set of jigs that provide for the drilling of racks in accurate relation to the pitch line of their teeth.

Boring gear rings six at a time in a lathe fixture. Threading adjusting nuts with a tap which is used as a chasing tool, with one cutting edge only in operation.

In the manufacture of the universal grinder built by the Cincinnati Grinder Company, Cincinnati, Ohio, a large number of jigs and fixtures is employed, several of which, as used under the driller, in the lathe and miller, are illustrated by the accompanying engravings.

A Locating Jig on the Bed

The jig shown on the bed under the radial driller in Fig. 1 is used for locating and boring the bearing holes for the vertical pinion shaft which operates the reciprocating table. With this jig two different sized holes are put through the bed, one near the top for the large upper end of the pinion shaft, and a smaller one through the boss at the center of the bed for the reduced lower end of the shaft. The bushing for the latter hole is carried in a goose-neck extension below the jig plate, as clearly shown in the halftone.

The jig is provided with bearing surfaces on the bottom which fit the flat and V-ways on the bed. It is located endwise in reference to the opening in the front of the bed, which receives the "automatic plate" on which the mechanism is carried for controlling the movements of the table. It will be noticed that the jig has a depending arm at the front with a short cross-bar, which serves as a locating gage in setting the jig endwise in proper relation to the ledge surrounding the plate opening, thus, insuring the edge of the plate matching up with the bead on the bed when the machine is erected.

The pinion-shaft bearings in this size of bed are drilled $1\frac{13}{32}$ and $1\frac{7}{32}$ inches and reamed to $1\frac{5}{16}$ and $1\frac{1}{4}$ inches respectively. The drills and reamers with their guide bushings are shown on the bed and a cutter bar is also visible there with a flat cutter which is used for facing the surfaces around the holes.

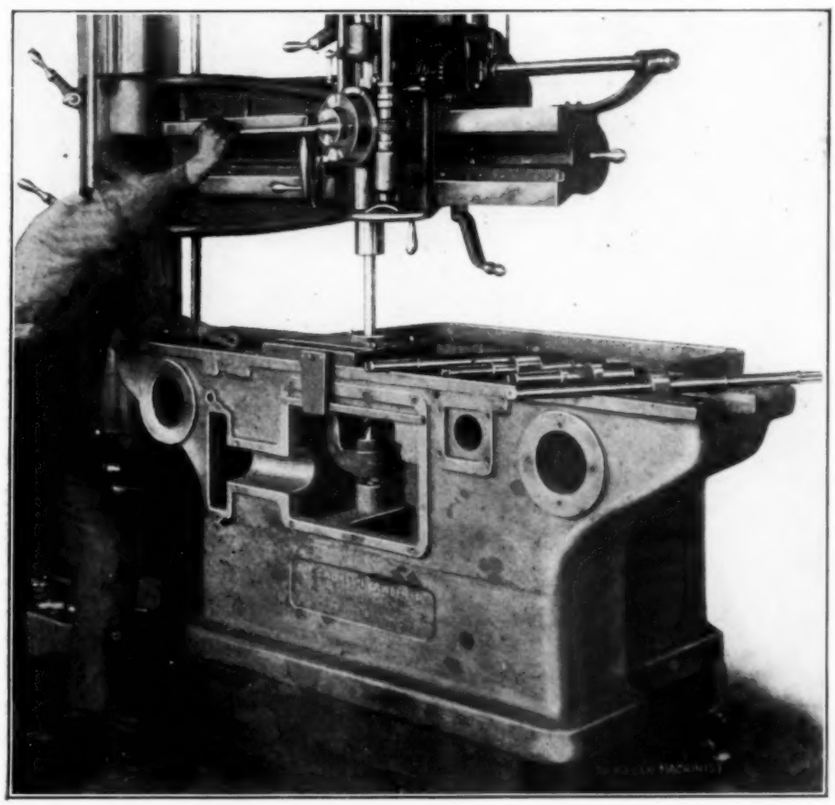


Fig. 1. Cincinnati Grinder Bed under the Radial Drill

Box Jig for Drilling a Plate

Fig. 2 illustrates a big box jig for drilling and boring the holes in the "automatic plate," and for facing the bosses and bearing surfaces. It consists of a simple box casting and a cover which is shown to the left of the jig body. The work already drilled is seen in place in the jig where it is positioned and secured by stops and screws. It is planed on the back before it comes to the jig, and here it rests with two edges against two stops at right angles, so that two thumb screws hold it up to the stops and prevent side movement.

With this jig over fifty holes are put through the work, and some of these are in lugs and surfaces such a distance from the outer walls of the jig that the guide bushings are placed in supplementary ribs across the interior close to the surface to be drilled, long drills being used to reach the work.

The surfaces finished by the facing tools are machined after the jig cover is removed. One of these surfaces, at the bottom of the gear chamber in the face of the work, has to be finished an exact distance below the outer face of the casting and this depth is tested by the gage shown in front of the jig.

Large Boring Jigs

Two large jigs are illustrated in Fig. 3 for boring gear boxes for two sizes of grinders. The smaller of the two is represented with a gear box in position for boring.

In these jigs the planed gear box is located by a tongue which afterward positions it upon the grinder and which fits a groove across the seat in the jig. The stop screws and holding straps are arranged as indicated. The boring bars are adapted to carry suitable cutters and are guided in accurately alined bearings in the jig walls. The end of the bar is formed for a floating drive in connection with the spindle of the driller. These jigs, like the other large ones shown in this article, are used under the Cincinnati-Bickford radial driller as illustrated in Fig. 1.

In addition to the boring of the main holes in the gear cases, the jigs in Fig. 3 also accomplish the drilling of the holes in the back of the case by which it is

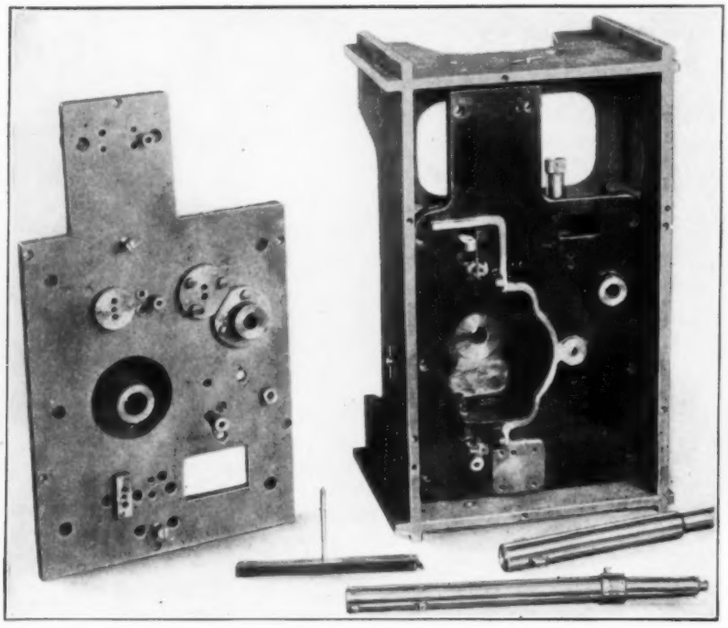


FIG. 2. DRILL JIG AND COVER FOR LARGE "AUTOMATIC" PLATE

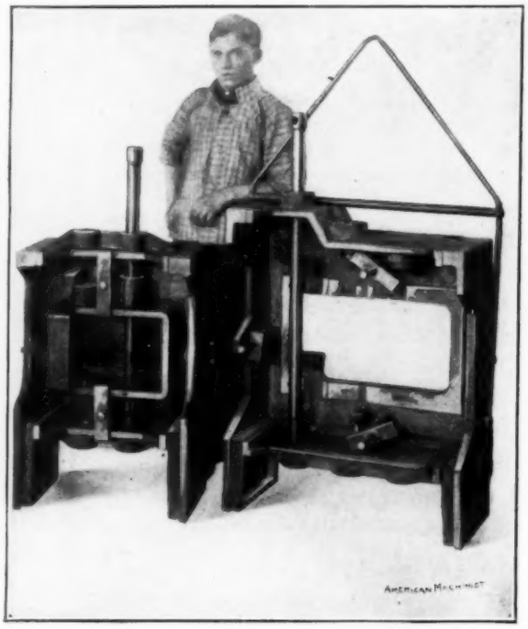


FIG. 3. LARGE BORING JIGS

attached to the grinder bed, and drill still another hole for the pinion shaft by which the speed changing pull-shaft is operated.

To facilitate the handling of these heavy jigs strong slings or yokes of round iron are provided which hook under studs in the side of the jig and allow the whole outfit to be picked up readily by the hoist.

DRILLING SMALL HOLES IN GEAR BOXES

The holes for the gear-box cover screws and the oil holes are drilled with the aid of the jig and cradle shown in Figs. 4 and 5. There are also four small holes drilled here for retaining screws which hold the bearing bushings in the gear box.

The oil holes are put in at a slant and the cradle upon which the gear box is located by its tongue, is planed on the bottom to an angle of 30 degrees, so that the two settings of the work for the vertical and oblique holes are obtained by merely tilting the cradle from one position to the other. When in horizontal position, the cradle is held against tipping during the drilling operation by a support which slips under a lip at the end of the casting.

The jig, when dropped upon the gear box, is located in one direction by the machined opening in its lugs which fit over a shaft slipped through the main bearing holes bored through the box. The side position of the jig is fixed by a pin in the lug which projects from the side of the box, this pin entering a hole in the bottom of one of the lugs on the jig. This hole by the way, is the one drilled in the previous operation in the jig, Fig. 3, and referred to already as the hole for the pinion shaft which operates the pull-pin for changing the gear speeds in the box.

JIGGING THE BEARING BUSHINGS

The cast-iron bushings used as bearings in the gear box are drilled for retaining screw holes and oil holes by means of the small jig shown in front of the cradle. The jig has two bearing surfaces at the bottom, at an angle of 30 degrees to each other, and after the bushing to be

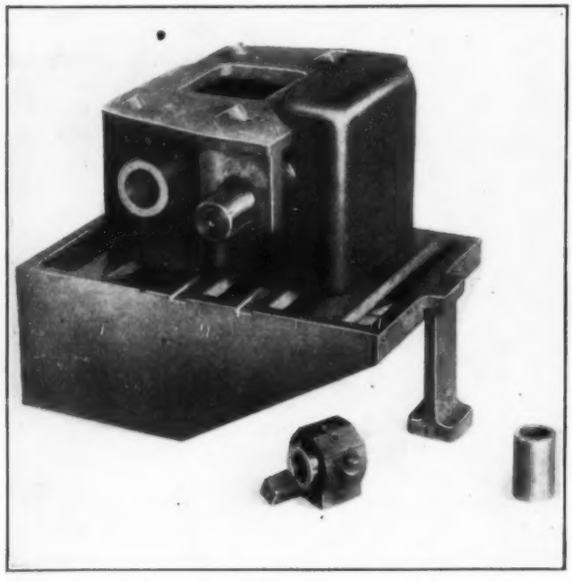


FIG. 4.

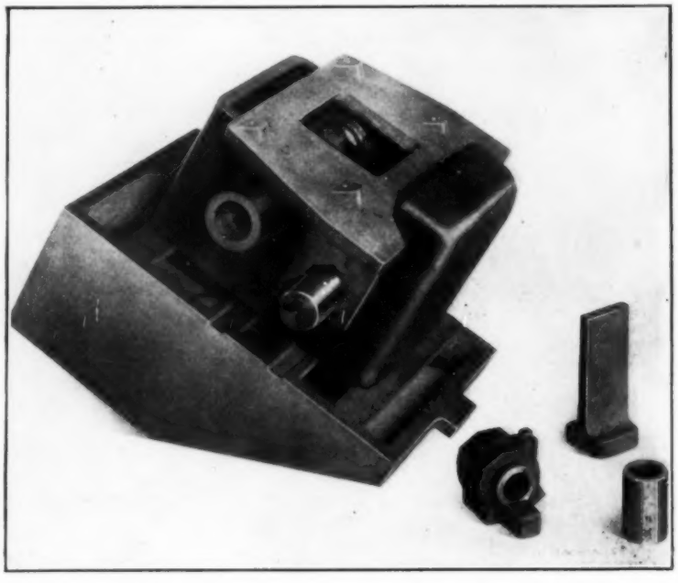


FIG. 5.

JIG AND CRADLE FOR DRILLING GEAR BOXES

drilled is secured by the clamping screw the two holes are drilled at the required angle by resting the jig first on one face, then on the other.

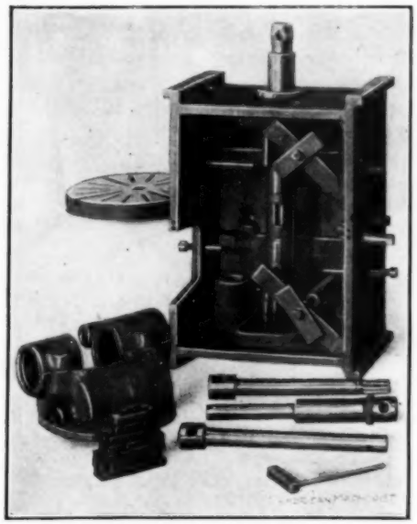


FIG. 6. BORING FIXTURE FOR WHEEL STAND

The bushing is faced to an exact length and is located endwise in the jig by a stop lug. The relation between this lug and the drill bushings (as well as the distance maintained between the locating screw holes drilled at opposite ends of the gear box by the cradle jig) is such that when the two bearing bushings are secured in their seats in the box by means of trunnion-pointed screws, their inner ends are an exact distance apart. The gear shaft running in these bearings is shouldered at the ends and the method of locating the bushings by the jig operations described, allows the shaft and its bearings to assemble with the small amount of end play desired, without resorting to the cut-and-try process.

WHEEL STAND BORING TOOLS

The method of boring wheel stands is indicated by Fig. 6, which shows all the tools as used in the radial machine.

The wheel stand is secured in the bottom of the boring fixture and a bar with five cutter slots is made use of in boring, counterboring and end facing the bearings. Several cutters of the type employed will be noticed in front of the wheel stand. The engraving also shows the bars and reamer for finishing the hole in the stand for the gear shaft.

MISCELLANEOUS DRILL JIGS

A group of jigs is represented in Fig. 7 for drilling a number of levers, bearings, etc.

The bent lever at *A* is centered at the inner end by a V-block in which the boss rests, while the end for the handle is centered in a threaded cup bushing which screws down over the end of the work. The hole drilled with the aid of this bushing is for the reception of a machine handle which is driven into the cast-iron lever.

Another bent lever is shown in the jig *B*. This lever controls the table-and-work-starting-and-stopping mechanism. The method of holding it in the jig is clearly shown.

Jig *C* is for drilling three styles of backrests, one of which is represented in place in the view. Jig *D* holds a cast-

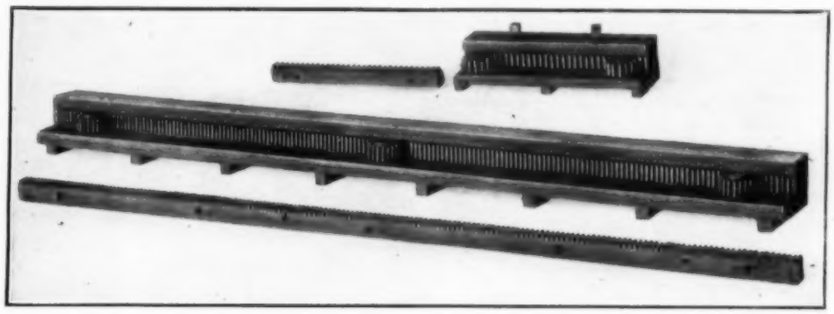


FIG. 8. RACK DRILLING JIGS

ing known as the cross-feed pinion bearing, while the central hole is put through its hub and four holes for fastening screws are drilled through the flange. The hole is put through the solid metal for the bearing with a twist drill, after which the bushing is removed and a rose reamer run through to size the bearing.

The jig at *E* holds a cast-iron box for the drilling of screw and oil holes. A plug is slipped through the hole previously bored through the box, and two taper faced pins at *F F*, which are driven into the holes in the jig lugs, act as wedges upon the ends of the central plug and draw the work down tight on the planed seat in the jig. One end of the plug has a shoulder pressing against the end of the work and this is also beveled so that the pin when driven over it at the same time forces it and the work against the other end of the jig which thus serves as a locating stop. The guide bushing for the oil hole drill is located at the top of the jig; the bushings for the screw

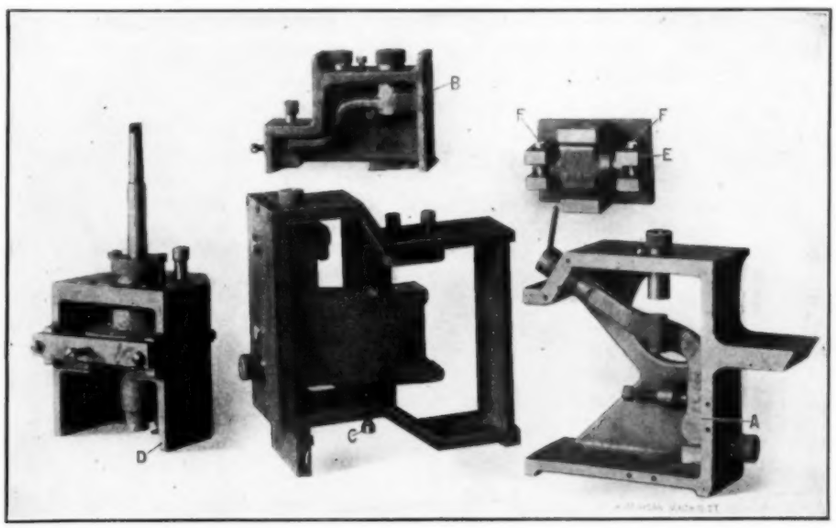


FIG. 7. A GROUP OF DRILL JIGS

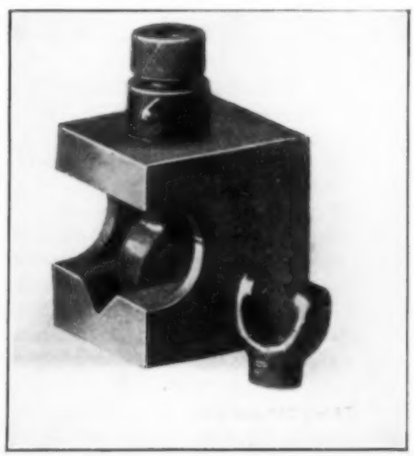


FIG. 9. JIG FOR UNIVERSAL JOINTS

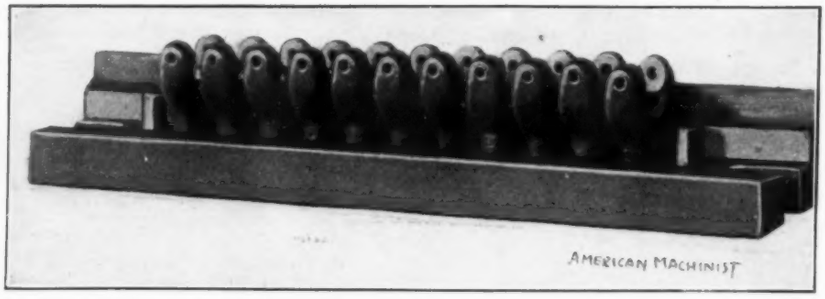


FIG. 10. FIXTURE FOR MILLING UNIVERSAL JOINTS

holes are in the rear face and, therefore, not visible in the halftone.

DRILLING RACKS IN RELATION TO THE PITCH LINE

The two jigs in Fig. 8 are constructed for drilling table- and wheel-slide racks in accurate relation to the pitch line, so that when assembled in the machine they shall mesh properly with their operating pinions.

These jigs are fitted with master pinions, which the racks to be drilled are pressed into contact with by means of setscrews at the rear of the jig. The holes for the retaining screws and dowels are then drilled, with the assurance that with this means of locating, the racks will operate correctly with their pinions in the grinder, without backlash and without binding.

The longer of the two racks requires five pairs of holes for screws and dowels; the other, two only. The enlarged openings for the screw heads are formed by counterboring after the rack is removed from the jig.

STRING MILLING FIXTURE

A jig is illustrated in Fig. 9, as used for drilling and reaming universal-joint members preparatory to the milling of the sides of the lugs, which is accomplished in the fixture, Fig. 10. The work is held in the jig by a threaded bushing, which is screwed down to press the piece into the V-block, which centers it for the drilling operation.

The pieces, after the drilling and reaming of the hub and drilling of the screw holes in the forks, are slipped over the upright plugs in the milling fixture and clamped by setscrews tapped through the rear wall of the fixture. A milling cutter is then run through the lot to size the fork openings to standard width.

MILLING CIRCULAR RACKS

The racks in Fig. 11 are made in two lengths, one of each being used in each grinder. The fixture for holding them for the milling of the teeth is designed for receiving six of each size. The work is held in V's with short clamps, which are made to enter the ends of two adjacent racks so that three clamps at each side suffice for each group of six racks.

A cutter with eight rows of teeth is used and a half dozen passes under the cutter completes the series of teeth in the racks.

FIXTURES FOR MILLING BOXES AND BRACKETS

The upper fixture in Fig. 12 holds six castings, which are already bored out to provide bearings for a certain shaft used on the grinder plate. In this fixture the work is located for the milling of the bottom surface, the cutter being set to a thin gage placed against the finished face of the fixture. The castings are slipped over a shaft which is secured by clamps in the V's in the fixture. There are two screws behind each casting in the fixture to hold it steady during the passage of the facing cutter.

The lower fixture in the engraving is adapted for resting on two different faces

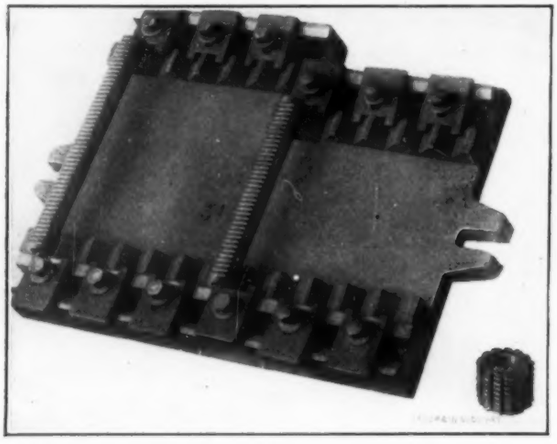


FIG. 11. A CIRCULAR RACK FIXTURE

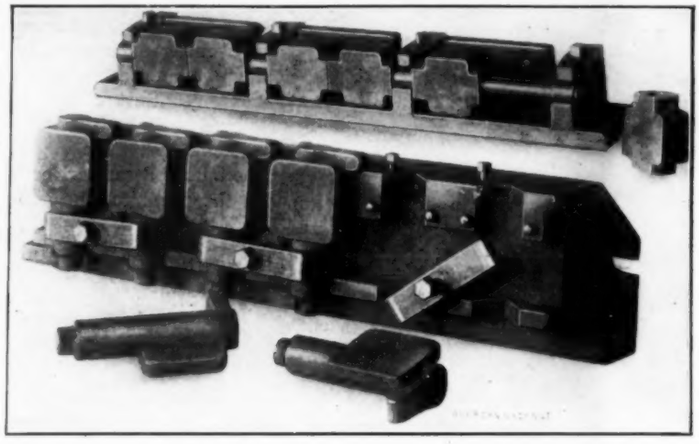


FIG. 12. MILLING FIXTURES FOR BEARINGS AND BRACKETS

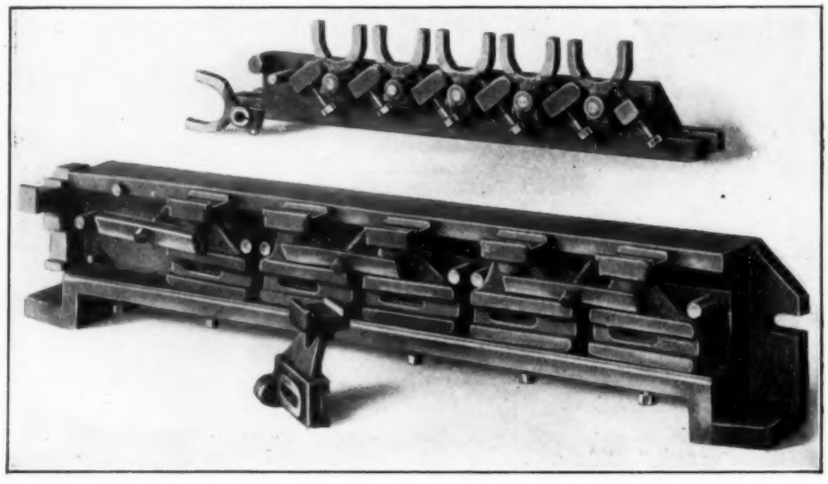


FIG. 13. MILLING FIXTURES FOR CLUTCH FORKS AND BACK REST ARMS

for the milling of two surfaces at right angles on the brackets shown. These brackets are placed in the V openings of the fixture and the flat pads rest against two supporting pins, one of which is fixed, while the other adjusts itself to the work and is then secured in place by a setscrew, as indicated. A single strap is all that is required for holding each pair of castings.

This fixture may be used on either the vertical or horizontal miller, as its two working faces allow it to be positioned as required for either type of machine.

Other Milling Fixtures

The fixture in the upper portion of the halftone, Fig. 13, holds six bronze clutch forks while they are straddle milled. These forks are first bored, drilled for the clamping screw and then split, after which they are slipped over plugs in the face of the fixture and secured by their clamp screws and by the stop screws, as represented.

The other fixture in this view is used for holding six vertical back-rest arms for the machining of the front and top faces. The castings rest in the fixture on three pins and the thrust due to the cutter is taken by stop pins. The cutters are set to a thickness gage placed against the fixed gage at the end of the fixture. This fixture is used on two faces to bring each of the surfaces to be milled in turn at the top.

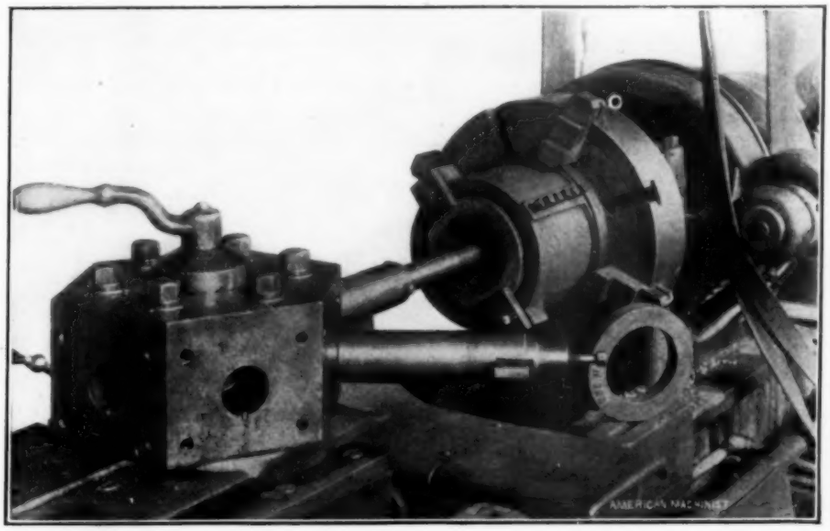


Fig. 14. Boring Out Gear Rings

Boring Gear Rings

Fig. 14 illustrates a method of boring spur-gear rings by holding them six at a time in a fixture on the faceplate of the LeBlond heavy-duty lathe. This fixture has two bearing ribs along its interior and the rings are pressed against these by the setscrews at the opposite side. The work is thus held securely by the three points of contact about the circumference and in addition two clamps are used at the outer end.

A turret slide is used on the shears of the lathe and two tools are secured in the turret. These are a boring bar with double-end cutter for roughing out the bore, and a finishing bar with adjustable single-point cutter, the latter bar being supported at the cutter end by a revolving pilot fitting a guide bushing in the spindle mouth.

About 1/64 inch of metal is removed by the finishing cutter and after removal from the lathe the rings are sized accurately by a hand reamer. They are then placed upon a roller-pin arbor, where they are faced and turned to size. In this operation the pin in the arbor forms a gage for the facing tools, which take the finishing cuts over the sides of the rings.

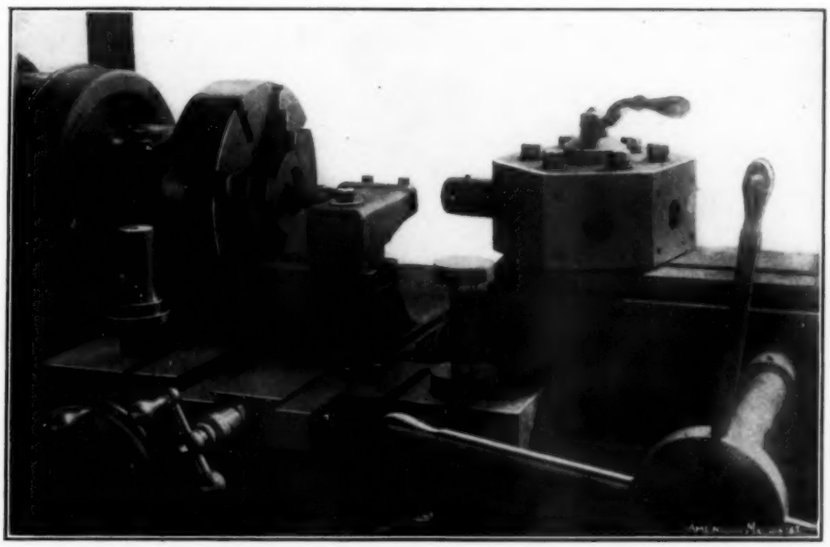


Fig. 15. Using a Tap as a Chasing Tool

The Tap as a Chasing Tool

Another lathe operation is shown in Fig. 15, which represents an interesting method of chasing the thread in a ring nut with a regular hand tap, which is secured in a special holder on the cross slide of the lathe.

In the first place a boring bar with two cutters is run through the nut. The first tool in the bar is a double-end cutter, and behind this is an adjustable single-point tool, which sizes the hole. The work is then ready for chasing.

The nut is of steel and is used for adjusting the wheel-head spindle boxes. The thread is of Acme form. The tap employed for the threading operation is considerably smaller than the bore of the nut, in order to clear at the rear of the hole. The tap is set in its holder with the face of one land level and on the center line of the work, and the lathe being geared for the corresponding thread, the one cutting edge of the tap is made to serve as a chasing tool, as it is passed through the nut at the proper rate of advance per turn of work.

The thread produced in this way, with a series of three cuts through the nut, is smooth and accurate, and the tap has long life, as the four cutting edges can be called into service as required. The gage for testing the threaded hole is shown on the lathe carriage, and at the left will be noticed a thread arbor on which the nut is run for the finishing of the faces and outside diameter.

The casting of other metals at first sight appears more simple than the casting of iron, but in reality is more complex, the reason being that while these metals melt at lower temperatures, they oxidize more easily, and are seriously affected by oxidation. This class includes principally brasses and bronzes, but in late years the alloys commonly used are so complicated that it is difficult to classify them according to the old system.

Machining Typewriter Segments

By Ethan Viall

Special automatic millers used for machining typewriter segments.

Details of the feeding and indexing mechanism of a special slotting miller.

A milling fixture that compensates for variation in castings.

Segment-inspecting gages, drilling jigs and details of a basket slotter.

Typewriter segments used in the Yost machine, as made by the Union Typewriter Company, Bridgeport, Conn., are cast in pairs as shown in Fig. 1, the halftone showing them just as they come from the mold, with the runner still in place.

After being broken apart, the segments are milled on the surface *A*, Fig. 2, and the dowel holes *B* are drilled, then the surface *C* is milled off for the type-bar seat, and the type-bar driver fulcrum wire slot *D* milled out, on the machine shown in this halftone.

In this machine two segments are held in the fixture head *E*, one of the segment castings being located by the pins *F*, which enter the dowel holes *B* and the casting is clamped in place by the clamp and thumb nut *G* and another similar clamp and nut which go on the stud *H*. The type-bar seat *C*, surfaced off by the large cutter, is backed by the two pins *I*

FIG. 1. SEGMENTS CAST IN PAIRS

to prevent springing, and the part in which the wire slot is milled is backed by the long pins *J* which are in turn held in position by thumbscrews. The other segment is placed opposite this one and held in exactly the same way.

The cross slide is set at a point giving the right depth of slot and it remains there until it is necessary to grind the cutters. The segments are placed in the revolving head, from the top, as they are alternately clear of the cutters in this position. The notifying bell is set to inform the operator as each segment is milled and has passed clear of the cutters, when the operator removes the finished segment and inserts another without stopping the machine, there being ample time to make the change while the revolving head is being operated and the segment in the opposite side of the head is being milled. This arrangement avoids lost time, and the machine is kept in continuous operation.

CUTTING TYPE-BAR DRIVER SLOTS

After leaving the machine just described, the castings are placed in the machine shown in Fig. 3, and the type-bar driver slots automatically sawed out, one of the slotted segments being shown at *A*. The reciprocating movement of the table is obtained by means of the cam *B*, which is driven by a worm and worm gear from the shaft *C*.

The indexing mechanism and some of the other details of the slotting machine are more plainly shown in Fig. 4, which shows the indexing head with the segment removed. The method of driving the milling saw through a chain of helical gears from the miller spindle, is plainly illustrated, the extension bracket being necessary in order to cut the driver slots without interfering with the other parts of the segment or of the fixture. The spacing lock *A* of the indexing mechanism, is released as the table is backed by the cam at the finish of a cut, by the outer end of the lock striking the stop *B*, which is bolted to the table bed. The hook end of this lock or dog, is held firmly in the rack *C* by the spring *D* when not in contact with the stop. The segment is located on the fixture by the dowel pins *E* and *F*, and it is clamped in place by the clamps *G* and *H* and also by *J* and *K*, the clamping scheme being more plainly shown in Fig. 5, where the indexing head is turned around. In this halftone the opposite end of clamp *G* is shown designated by the same letter as in the previous cut and it will be seen that after the lower part of the segment to be slotted has been dropped into this clamp, it is tightened by screwing up the nut on the outer end, then the setscrew *I* is tightened, the double action compensating for any variation in the casting and affording a solid support without springing it out of shape.

The indexing of the head is done by the dog *K* which engages the circular rack *L* when it is in normal position, the dog being operated as the table draws back by the bell crank *M* striking the stop *N*, the action occurring just after the lock *O* has released the other rack. On the forward movement of the table the spring *P* is kept from pulling the bell crank and dog around too far by the stop *R*. The wire handle *S* is used to pull back the dog *K*

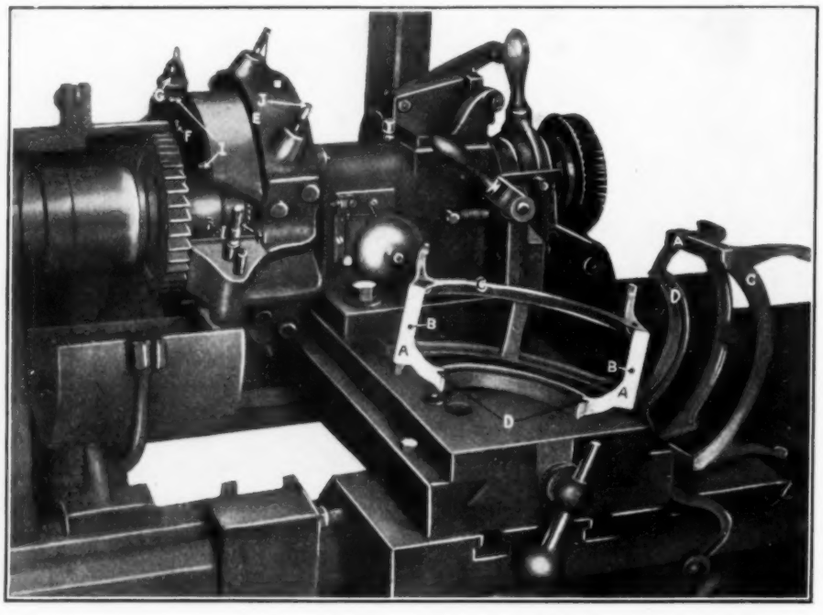


FIG. 2. MILLING TYPE-BAR SEAT AND TYPE-BAR DRIVER FULCRUM-WIRE SLOT

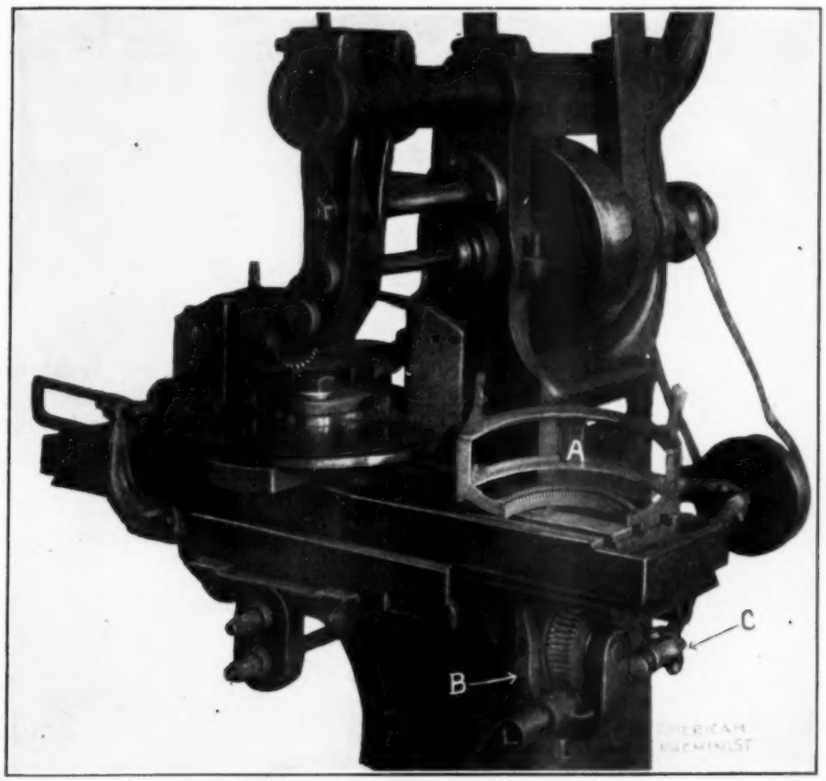


FIG. 3. CUTTING TYPE-BAR DRIVER SLOTS

when turning the index head backward by hand.

MILLING KEY LEVER COMB SEATS

The next operation, after leaving the machine just described, is to mill the key-lever comb seats *A* and *B*, Fig. 6, these ends being placed in the compensating clamps *C* and *D* and the jaws tightened by screwing up the hand nuts *E* and *F*, after which the clamps are locked in place by turning *G*, which operates the rack *H* and turns two nuts on the inner ends of *J* and *K*; *J* and *K* being bolts passing through elongated slots in the clamps *C* and *D*, which allows them a certain amount of horizontal movement when being closed by the hand nuts previous to the final locking, which, of course, is not done until after the clamps *L* and *M* have been screwed down, the segment being located by the pins *N* and *O* which enter the dowel holes as in all other operations.

Fig. 7 shows the segment in place in the fixture ready to be milled, both seats being cut at once as shown.

GAGING THE MILLED SURFACES

The surfaces *A* and *B*, Fig. 7, are milled in another fixture and then the segment is placed in the gaging fixture shown in Fig. 8, for the inspection of all the milled surfaces, the block *A* just fitting between all parts marked with a cross, if correctly milled.

THE DRILLING JIGS USED

All holes in segments, with the exception of the dowel-pin holes previously mentioned, are drilled in the jig shown in Fig. 9, the segment being placed in the jig, located by the dowels, clamped securely, the top closed down and the two holes *A* and *B* drilled through the bushings *C* and *D*, after which the pins *E* and *F* are pushed in and all the rest of the holes drilled before the casting is removed from the jig. Fig. 10 shows the inside of this jig with segment removed, giving a clear view of the clamping and locating plan.

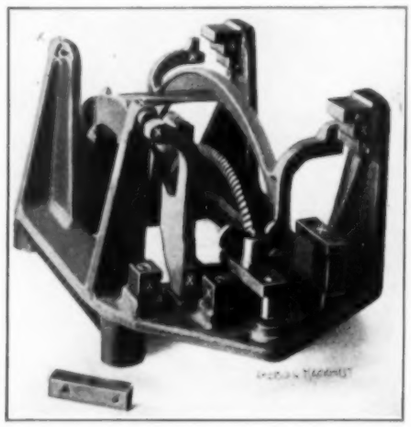


FIG. 8. JIG GAGE FOR MILLED SURFACES OF SEGMENTS

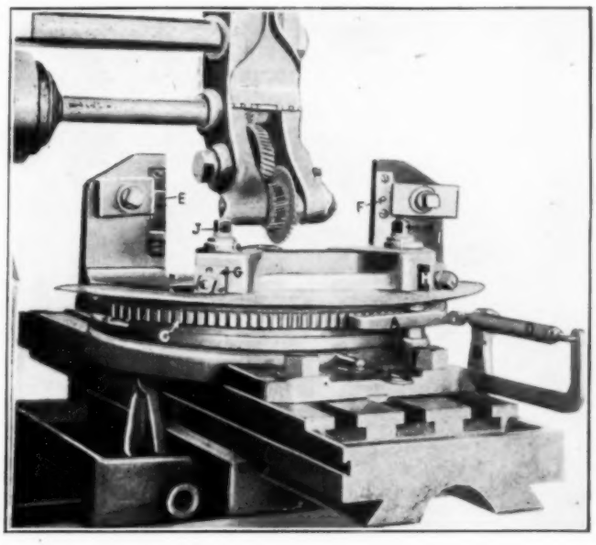


FIG. 4. PART OF INDEXING MECHANISM

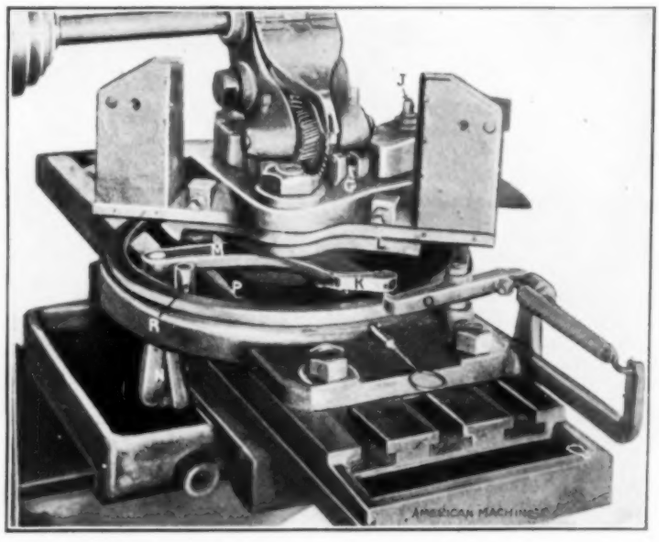


FIG. 5. MORE OF THE INDEXING DETAILS

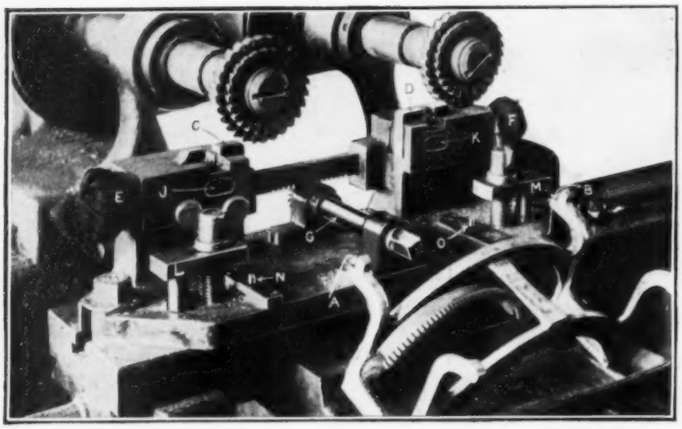


FIG. 6. MILLER AND FIXTURE FOR MILLING KEY-LEVER COMB SEATS

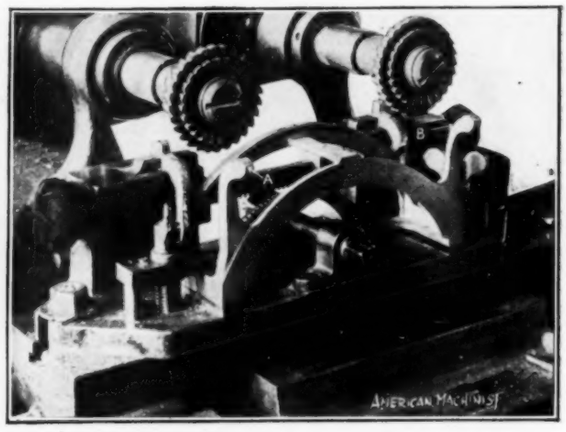


FIG. 7. KEY-LEVER COMB-SEAT MILLER WITH SEGMENTS IN PLACE

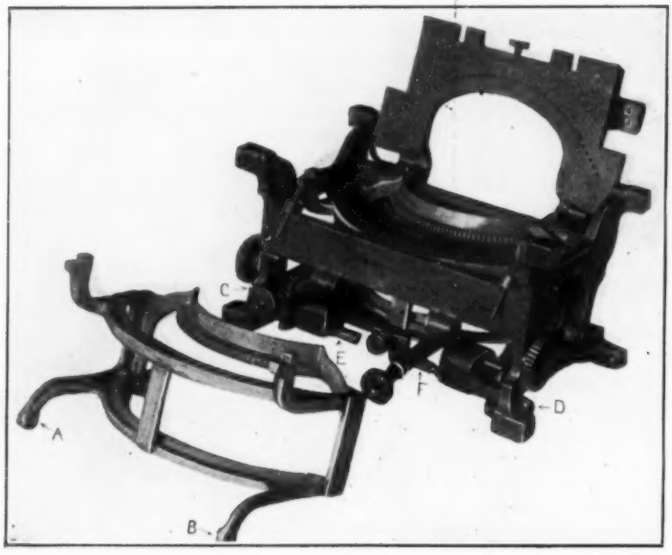


FIG. 9. SEGMENT-DRILLING JIG WITH TOP OPEN

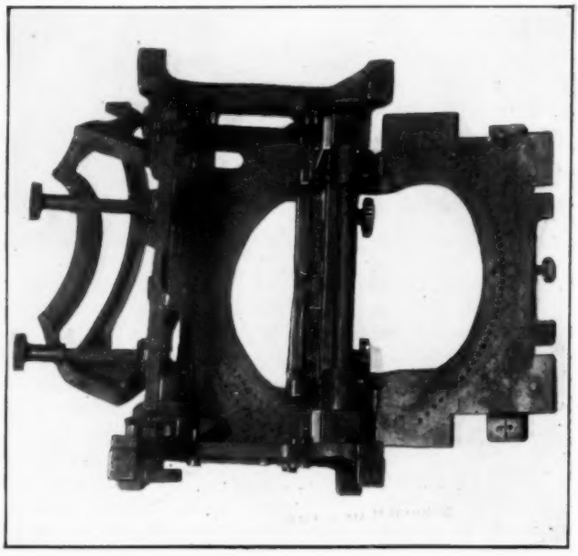


FIG. 10. VIEW OF INSIDE OF SEGMENT-DRILLING JIG

INSPECTING THE SLOTS

Final inspection is made of the correctness of the type-bar driver slots and the type-bar fulcrum wire slot with the gages *A* and *B*, Fig. 11, both gages being located by the dowel holes.

In using gage *A*, it is clamped on the segment and the two feelers *C* and *D* inserted in the end slots; then the other slots are inspected one at a time with the swinging gage *E*, which has an indicating pointer *F* to show the radial variation.

Gage *B* is placed on the segment in the same way as the one just described, and the depth of the wire slot is measured by the feeler *G*, the pointer *H* indicating the correctness.

Fig. 12 shows both gages in position for use, the feelers themselves, of course, indicating the correct width of the slots, regardless of the pointers in either case.

SLOTTING BASKETS

An automatic machine for cutting the type-bar driver slots, in what are known as "baskets" for one of the old style ma-

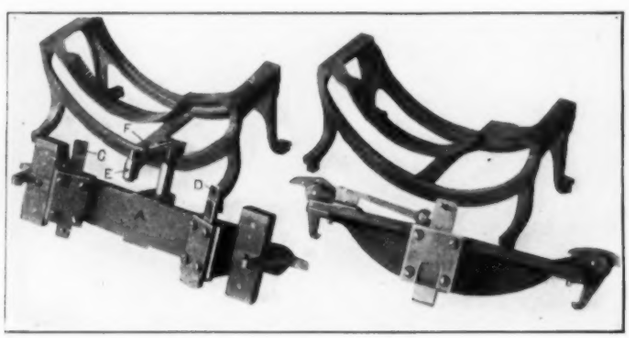


FIG. 11. GAGES FOR TYPE-BAR DRIVER SLOTS AND WIRE SLOT

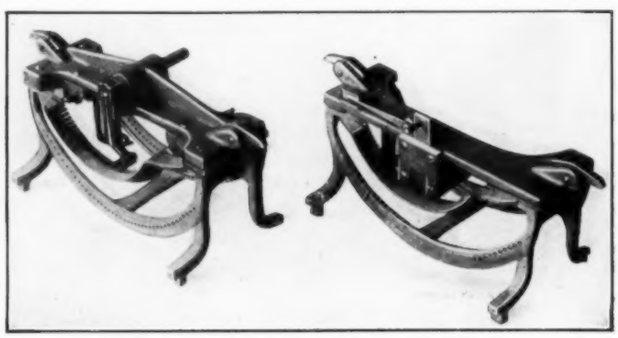


FIG. 12. GAGES IN PLACE ON THE SEGMENTS

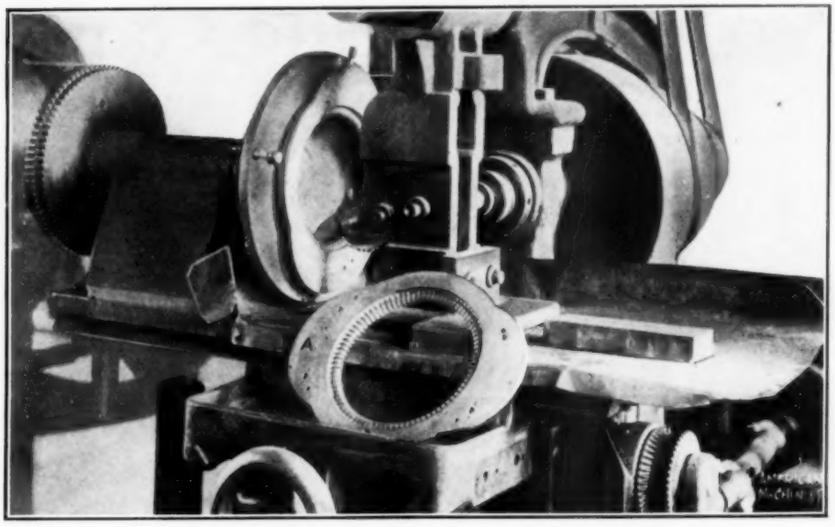


FIG. 13. MACHINE FOR SLOTTING BASKETS FOR UNDERSTROKE MACHINES

chines is shown in Fig. 13, one of the baskets being shown at *A* as well as one on the fixture.

While this machine is somewhat similar in principle to the one shown for slotting

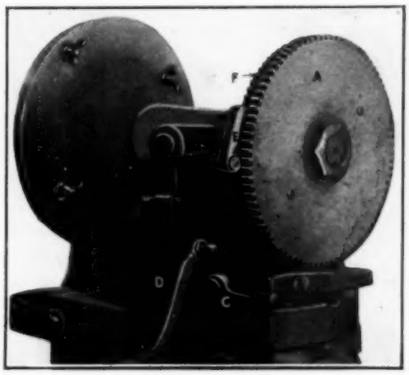


FIG. 14. DETAILS OF INDEXING MECHANISM

segments, the indexing mechanism is adapted to a horizontal spindle, with the same table motion as in the previously described one. The details are clearly shown in Fig. 4, *A* being the dividing disk locked by lever *B*, which is operated through lever *C*, by a cam on stop *D* as the table moves. The indexing is done by the hook dog *E* catching the teeth on disk *F*, the dog being given its movement by bell crank *G*, the lower end of which strikes stop *D* when the table reverses.

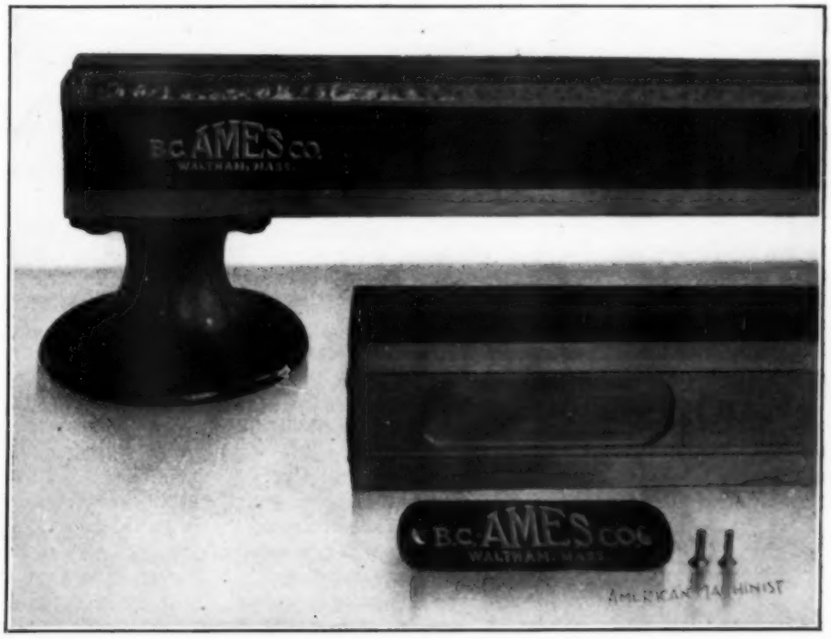
A Bench Lathe Name Plate

The bench lathes built by the B. C. Ames Company, Waltham, Mass., are provided with a name plate which is of such form and so attached as to present the appearance of having been cast with the bed.

The actual form of the plate and the method of securing it in place will be seen upon inspection of the halftone.

The bed of this bench lathe is machined along the face as well as on top so that when that portion below the ways is painted it will present a smooth, neat appearing surface. After the front is surfaced as shown in the engraving, an end mill is used to cut out a pocket the size and depth of the plate which is to be inserted. The mill is about 1½ inches in diameter and it requires but a few moments to form the seat for the plate.

The cast-iron plate, with the faces of the letters ground off to give them a bright appearance, is placed in the pocket and fastened by two countersunk head screws. The joint and screw heads are then filled and the bed painted. The letters on the name plate then look as if they were actually cast on the front of the bed.



A BENCH-LATHE NAME PLATE

Babbitt Metal versus Bronze

BY H. E. BRIDGEWATER

It has been our experience, and, we find, the experience of some other users of machine tools having lead screws for feeding the tool carriage, that the screw nuts lined with babbitt metal give far better service as regards wear, than similar nuts made of bronze, and we wonder if there is any other reason for the use of the latter than that of resisting wear.

On the screws where the bronze nuts travel the oil is always discolored by the bronze, indicating undue wearing away; also in the case of the cast-iron nuts, the oil becomes darkened, which shows that the cast iron also is wearing off into the oil, but in the case of the babbitt nut there appears to be no deposit in the oil on the screw that would indicate any wear. This, coupled with the fact that back lash accumulates more quickly in the case of the bronze, leads us to believe that the babbitt nut is to be preferred, especially in view of the fact that it can be more easily renewed than bronze.

In a paper recently read before the North East Coast Institution of Engineers and Shipbuilders it is stated that as a chip producer, the lathe is the most economical of machine tools. A well-designed lathe, under favorable conditions, produces half a pound of chips per horsepower per minute when cutting mild steel, the pressure on the tool being approximately 100 tons per square inch "area of cut"—this last meaning the depth of cut multiplied by the feed; a cut one-half inch deep with a one-eighth-inch feed having an area of one-sixteenth of a square inch.

The Design of Automobile Cams

By R. A. Niven

Cam dimensions and how such dimensions are determined to effect proper valve timing.

Machining the cams and shafts.

Several articles have appeared recently in the AMERICAN MACHINIST under the titles of "Automobile Engine Proportions," "Valve Timing of Automobile Engines," and other headings pertaining to automobile design, but I have not seen any details of cam dimensions, and how such dimensions are determined to function the valve-timing diagrams given.

From an experience of many years in experimental combustion-engine construction and numerous tests made of this form of prime mover, and also a study of the published data on combustion-engine design, including the material that has been published in the AMERICAN MACHINIST (see particularly Tables 1 and 2, appearing on pages 913 and 914, Volume 33), it does not appear to me that valve timing of automobile motors within very narrow limits of variation is an absolute necessity to insure good—I might say, best—operation. The tables referred to above and other data that have come within my notice, certainly give a wide variation of valve timing, and each designer claims his timing superior to all the others, but from the motor performances it is a difficult task to decide whose claim is the most valid.

When we speak of a four-cycle combustion motor we mean a motor that requires four strokes of the piston to function one complete cycle of events within the cylinder, as follows: Fuel intake, compression, explosion or power and exhaust strokes.

During four strokes of the piston the crank shaft rotates twice, and as but one cycle occurs in this time, the cam shaft should rotate one-half as fast as the crank shaft. Hence for any angle of rotation of the crank shaft the cam shaft should rotate but one-half this angle.

Positions of the Crank Pin

In Table 1, referred to above, the angular positions of the crank pin given in one case when the valves open and close are as follows: Exhaust opens ahead of bottom center line, 39° 45′; exhaust closes past top center line, 12° 30′; intake opens past top center line, 26° 15′; intake closes past bottom center line, 26° 15′.

This case is taken because it affords a good example for the illustration of how to determine cam dimensions. An important factor in solving this problem is the clearance between the valve pusher and valve stem. Any variation of this clearance will vary the timing for the same cam dimensions; that is, the positions of the crank pin when the valves open and close will vary as the clearance between the pusher and the valve stem is varied. Hence to retain the same timing with an increase or decrease of clearance the angular dimensions of the cams must be increased or decreased. This increase or decrease of cam angular dimensions may be called the clearance cam angle.

The term valve pusher is used here instead of valve lifter, because all valves are not lifted up off their seats. Some are pushed down and some operate horizontally. The term valve pusher will cover all types. Two other factors that have to be taken into account are the diameters of the so called base circle of the cam and of the so called valve-pusher roller. Any change in these dimensions requires a change in the dimensions of the cams to retain the same timing of the valves.

Calculating the Clearance Angle

We assume the diameters of the base circle, the pusher roller, and the clearance. From these we calculate the clearance angle of the cams.

If we consider the positions of the crank pin when the valves open and close, the exhaust will remain open during a total crank angle of

$$39° 45′ + 180° + 12° 30′ = 232° 15′$$

The intake valve opens 26° 15′ past top center line and closes 26° 15′ past bottom center line, and is, therefore, open during a total crank angle of 180 degrees.

The cam shaft rotates one-half the angle of the crank shaft; hence, the cam acts on the exhaust valve while rotating through an angle of

$$\frac{232°15'}{2} = 116°7'30'',$$

and acts on the intake valve during an angle of

$$\frac{180°}{2} = 90°.$$

In Fig. 2, the large circle represents the base circle of the cam and the small circles the roller, or in the present case the rounded end of the lever shown in Fig. 1; the full-line small circle, Fig. 2, represents the roller where there is clearance between the pusher and the valve stem and the dotted circle represents the roller where there is no such clearance.

Assume the dotted line PR, Fig. 2, to represent one face of either exhaust cam when there is no clearance and the valve is about to open, the direction of rotation of the cam being as indicated by the arrow in Fig. 1. The valve will remain open while the crank shaft rotates through an angle of 232° 15′, and the cam rotates one-half 232° 15′, or 116° 7′ 30″, and the dotted line PQ will represent the other face of cam when the valve is just closed. The angle α, Fig. 1, assuming these conditions, would be equal to 116° 7′ 30″. Now, when—as represented by the full-line circle, Fig.

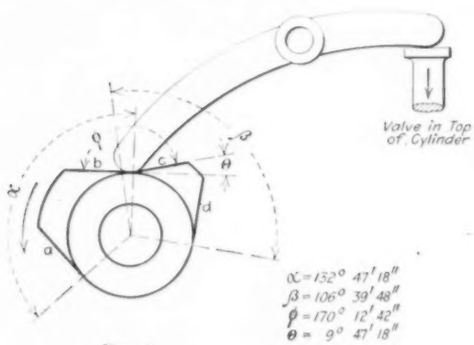


FIG. 1

FIG. 2

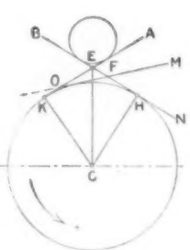


FIG. 3

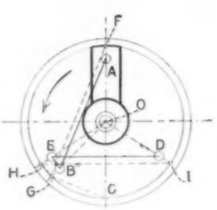


FIG. 4

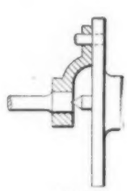


FIG. 5

DESIGN OF AUTOMOBILE CAMS

2, as before—there is clearance between the pusher and valve stem, the full line AK will represent the face of the cam when the valve is about to open and the line BH will represent the other face of the cam when the valve is just closed. Hence, if the valve is to remain open while the cam rotates 116° 7′ 30″, the angle α must be increased by the two angles RVA and BWQ and $\alpha = 116°\ 7'\ 30'' + RVA + BWQ$. The angles RVA and BWQ are equal to each other and equal the clearance angle. Therefore, α = 116° 7′ 30″ plus twice the clearance angle. The angle β of the intake cam will likewise equal 90 ° plus twice the clearance angle.

In Fig. 2 it will be seen that the lines AK and BH, representing the cam faces, are tangent to the base circle and the roller. By geometry a tangent is perpendicular to the radius to the point of tangency. If, therefore, we draw the lines AK and BH tangent to the circles, Fig. 2, and draw the radii CH and CK to the point of tangency, the angles CKA and CHB will be right angles. Prolong the radii CH and CK to D and E, respectively, and draw GD and GE, respectively, parallel to BH and AK. Then as AK and BH are tangent to both circles, the lines CD and DE are each equal to the sum of their radii. From trigonometry

$$Cos.\ DCG = cos.\ GCE = \frac{CD}{CG} = \frac{CE}{CG} = \frac{radius\ of\ base\ circle + radius\ of\ roller}{\left(\begin{matrix}radius\ of\ base\ circle + radius\ of\ roller + \\ clearance\end{matrix}\right)}.$$

The following dimensions have come within my experience: Diameter base circle, 1½ inches; diameter of roller (Fig. 1, the end of lever), ⅜ inch; clearance, 0.010 inch.

$$Cos.\ DCG = cos.\ GCE = \frac{0.750'' + 0.1875''}{0.750'' + 0.1875'' + 0.010''} = 0.98945,$$

and each of the angles DCG and GCE equals 8° 19′ 54″.

Also, CH and CK are, respectively, perpendicular to BH and AK, and CG is perpendicular to ER. Hence, the angles DCG and GCE are equal to the angles RVA and BWQ, equal to the clearance angles. Therefore, the angle of the exhaust cam, Fig. 1,

$$\alpha = 116°\ 7'\ 30'' + 2\ (8°\ 19'\ 54'') = 132°\ 47'\ 18''$$

and the angle of the intake cam

$$\beta = 90° + 2\ (8°\ 19'\ 54'')\ 106°\ 39'\ 48''$$

The Effect in Angular Displacement of the Clearance

Therefore, a clearance of 10 one-thousandths of an inch causes an increase of 16° 39′ 48″ in the theoretical angle of the cams. In other words, if we had a loss motion of 10 one-thousandths of an inch between the cam and valve stem, the crank-pin angle, while the valve remained open, would be reduced 33° 19′ 54″. For the relative position of exhaust and intake cams, for the same cylinder, on the shaft, we have from the data, the exhaust valve closes 12° 30′ past top center line and the intake opens 26° 15′ past top center line. The crank pin, therefore, rotates 13° 45′ between the time the exhaust closes and the intake opens. The cam rotates one-half this angle, or 6° 52′ 30″.

In Fig. 4, suppose that the angles HCE and ECK are each equal to the clearance angle and the angle MOA is equal to 6° 52′ 30″, the angle the cam rotates between the time the exhaust closes and intake opens. The angles CHB and CKA are right angles. Hence the angles CEH and CEK which are equal to each other are each equal to 180° — [90° + (8° 19′ 52″)] = 81° 40′ 6″. The angle AEB, which is equal to HEK, is equal to

$$2\ (81°\ 40'\ 6'') = 163°\ 20'\ 12''.$$

The angle BFM, Fig. 3, which is equal to ϕ, Fig. 1, = angle BEA + AOM =

$$163°\ 20'\ 12'' + 6°\ 52'\ 30'' = 170°\ 12'\ 42''.$$

The angle MFN, Fig. 3, is equal to 180° — (170° 12′ 42″) = 9° 47′ 18″ equal to angle θ, Fig. 1.

Approximating the Angle

It is clear that the angles above cannot be obtained on the miller dividing head, but can be approximated within the limits of mechanical skill and human error by the chord subtending the arc method. As stated above I do not think it necessary that cams be made to such degree of refinement as here computed, but, there appears at times no limit to the "stunts" the experimental machinist is called on to execute, and it will surprise so called "practical men" how easily and with what precision the problem of angles of any magnitude can be solved by anyone who can read a handbook intelligently.

Machining the Cams and Shafts

If the cam shaft of an experimental motor or motor of new design be integral, that is if the cams and shaft are to be in one piece, it is made from a bar large enough to make the cams the proper throw and then mill the angles in their correct relation to each other. When roughing the shaft down leave one end large enough so that a keyway can be cut in it, the bottom of which will not be below the surface of the shaft when finished; that is, so that the keyway will "turn out" when the shaft is down to size.

Fit a disk or faceplate, Figs. 4 and 5, about 10½ inches in diameter, on the miller dividing head, and on this disk draw a circle $FHGI$ exactly 10 inches in diameter. Any other diameter will do, but a 10-inch circle is the most convenient. Draw any radial line intersecting the circle in F. From geometry, the angle FCG, Fig. 4, is equal to one-half the angle FOG and the angle FGC is a right angle. From trigonometry the chord FG is equal to $CF \times sin.\ GCF$. If the angle FOG, Fig. 4, is equal to the angle α Fig. 1, which is equal to 132° 47′ 18″, then the angle GCF, Fig. 4, equals 66° 23′ 39″ and the chord $FG = 10'' \times sin.\ (66°\ 23'\ 39'') = 10'' \times 0.91632 = 9.163$ inches.

Therefore a light center-punch mark is made at F and a pair of dividers or trams is set, on an improved Brown & Sharpe rule for setting dividers to thousandths of an inch, to 9.163 inches. Then with F as a center draw an arc cutting the circle in G and draw the radial line OG. The angle FOG will equal 132° 47′ 18″. The angle θ, Fig. 1, is equal to 9° 47′ 18″, the chord GH is equal to $10'' \times sin.\ (4°\ 53'\ 39'') = 10'' \times 0.085315 = 0.853$ inches.

This chord is laid off from G to H as will be explained below and the angle GOH = 9° 47′ 18″. The angle β of the intake cam, Fig. 1, equals 106° 39′ 48″, the chord HI is equal to $10'' \times sin.\ (53°\ 19'\ 54'') = 10'' \times 0.8021 = 3.021$ inches and the angle HOI = 106° 39′ 48″.

Fit an arm on the end of the shaft, Figs. 4 and 5, and turn the outer end of this arm so that it will coincide with the circumference of the 10-inch circle, or in other words, make the length of the arm exactly 5 inches. Draw a line across the end of the arm and set this line to coincide with the radial line OF. Clamp the arm and disk together and drill a hole through both for a dowel with any size reamer drill, say ⅜; then set the line on the arm to coincide with the radial line OG, clamp the arm and disk together and drill another hole in the disk with the reamer drill, using the hole in the arm as a jig. In the same way drill holes in the disk with the line on the arm set to the radial lines OH and OI; then ream the holes through the arm and disk, using the arm as a jig. These holes are shown in Fig. 4 at A, B, E and D, and in Fig. 5 by the dowel pin through the arm and disks, the holes A and B being used for the exhaust cam as indicated by the line AB and the holes E and D for the intake, the holes being used in the order named, A to B to E to D, while the faces are being milled on the cams. It will be observed in Fig. 1 that the line representing the exhaust cam face if prolonged backward intersects the intake cam face making an angle of 9° 47′ 18″ so that the hole E must be laid off backward from B counting from A in the direction indicated by the arrow, to D as forward.

Care must be taken to lay the angles out and drill the holes with reference to how the shaft rotates when in the mo-

tor. Suppose we start with No. 1 exhaust cam; that is, with cam for the forward cylinder when the motor is in the car and the arm in position *A*, as in Fig. 4. We then mill the face *a*, Fig. 1, rotate the arm to *B*, and mill the face *b*, Fig. 1; turn backward to *E* and mill the face *c*, Fig. 1, on the intake cam; then turn to *D* and mill the face *d*. This completes the cam faces for one cylinder. Now if we move the arm back to *A* the shaft will be in the position in which we started to mill the cams for No. 1 cylinder.

If now, we index the dividing head one-quarter turn in the direction in which the shaft should turn for a four-cylinder motor or index one-sixth of a turn for a six-cylinder motor the shaft will be in position to mill the faces of the cams in the same order as before for the cylinder firing next in succession, and in the same way for the other cylinders, the cam faces will be complete and in their correct relation to each other.

Following a Fixed Schedule Under the Taylor System

By H. W. Reed

A number of opponents of the Taylor system have concentrated their criticism on that particular function of the system that compels a workman to follow a fixed schedule; that is, the instruction card, which gives not only the time for the completion of each piece, but also the method of operation. This brings up the much discussed question: Can a workman follow a fixed schedule showing each move of the method to be used and retain an incentive for originality? Or, in different words: Can he follow the speed and feed combination worked out by another and not lose his initiative and all personal ambition to excel at his chosen craft?

The opponents of the system say "No," and the charge is made that by this means the operator is transformed into a human machine, something incapable of thought, merely following the mechanical movements directed by the instruction card. Thus the system is creating a race of automatoms, keyed up to the highest speed obtainable without regard for their physical or mental welfare; destined after a few years of this unbearable pace to be relegated to the scrap heap as physical and mental wrecks, victims of increased production under scientific management.

These critics forget that the time-study men have been through the mill, thoroughly understand what the element of fatigue means to every producer, and aim to create, not destroy.

The claim has never been made that authors of these cards have more mechanical knowledge than the combined shop force; no systematizer would be idiotic enough to try to suppress thought and originality in the shop force, for it is through them that many ideal methods are brought to light.

Every shop has a system, good, bad or indifferent. The ideal under scientific management is to have the best. This feature enters into instruction cards as well as into other parts of the system.

Why Question Instruction Cards More Than Drawings?

Any mechanic will work to a drawing without question as to why such a piece should be made, the dimensions and finish called for will be followed. Then why should he object to the method of operation given him? If he admits that the management has the right to say what is to be made, it necessarily follows that it should have the right to say how it should be made.

If the critics of the instruction card were to suggest that the engineers of a railroad system should run the trains to suit their own convenience, they would be ridiculed. Were they to declare that each soldier should choose his own type of weapon, their idea would be looked upon as a mild type of lunacy. Yet they insist that each mechanic should choose the tool that appeals to him most, and run the tool and machine with any combination of speed, feed and depth of cut that he chooses.

Put 12 men on similar machines, give them the same piece to machine, check them up, and you will find 12 methods and a different time for each man. One of these methods, or a combination of parts of all 12, would be superior to the rest; but could you convince the others by merely telling them of it? Or, if they were open to conviction, what means would be used under the old school of shop management to find the superior method?

INSTRUCTION CARD FOR OPERATION 3 M 13 23 R B 2 C

1 Sheets, No. 1		Drawing No. 7766	Machine No. L 21	Order No. M 13 23 R	
Material Cast Iron	Class No. 13	Pieces in Lot	Time for Lot	Bonus	

Description of Operation

Rough turn and chamfer
Allow 35 per cent. bonus

Item	Detailed Instructions	Feed	Speed	Element Time per Piece	Time for Entire Lot	Continuous or Running Time
1	Change card				2.50	
2	Study instruction card and drawing				4.00	
3	Change from chuck to face plate				4.80	
4	Put drivers on faceplate and set approximately				1.60	
5	Adjust footstock to length				1.20	
6	Change speed and feed				0.80	
7	Set calipers to 10.$\frac{1}{4}$				0.68	
8					15.58	
9	Put piece on machine with aid of helper			2.40		
10	Clean and oil centers			0.60		
11	Put piece in centers and adjust centers			1.10		
12	Adjust drivers to dogs on end of piece			0.68		
13	Put in turning tool and set central			0.58		
14	Start machine; move tool to work			0.20		
15	Set depth of cut to rough turn to 10.$\frac{1}{4}$			0.68		
16	Rough Turn to 10.$\frac{1}{4}$—24" Run	0.200 BB	10.47 1AF	11.50		
17	Stop machine run carriage back			0.16		
18	Gauge and measure			0.60		
19	Take out turning tool			0.18		
20	Put in side tool and set			0.58		
21	Start machine; move tool to work			0.20		
22	Chamfer end of piece	HF	1AF	1.30		
23	Stop machine; take out side tool			0.18		
24	Take pc. out of centers with aid of helper put on floor			1.60		
25				22.54		
26	10 per cent. on machine time 12.80			1.28		
27	40 per cent. on handling time 9.74			3.90		
28				27.72		
29	Disassemble 4.00					
30						
31	Time for lot = (No. pcs. × 27.72) (4.00 14.90)					
32						
33	Time for 10 pieces = 296.10 minutes, 4.93 hours					
34						
35						
36						
37						
38						

When Machine Cannot Be Run as Ordered Machine Boss Must at Once Report to Man Who Signed This Card	7 Month	7 Day	11 Year	Signed Reed
				Checked

SPECIMEN INSTRUCTION CARD FOR A LATHE JOB

There is the "one best way" for every operation. This method once determined should be enforced on all succeeding lots. To do this, written instructions must be sent to the operator to insure uniform time and methods. This may be arbitrary, but it will accomplish the standardization of the operation.

A Specimen Instruction Card Printed Herewith

The sample instruction car is of a plain lathe operation. The time given for each item of the actual work on each piece is the minimum time possible. The element of fatigue is taken care of in the percentage of allowance on handling time. Under the Taylor system a card similar to this, together with a tool list calling for all tools necessary for the operation, is issued to the operator.

The value of the standardization of an operation is illustrated by the roughing cut on this card. On a ⅛-inch depth of cut the following combinations could be used on this machine. These combinations are based on the pulling power of the machine, and the pressure on the tool.

Revolutions per Minute	Feed in Thousandths of an Inch	Cutting Speed in Feet per Minute	Time in Minutes
10.47	0.200	28	11.50
16.21	0.080	43	18.50
20.15	0.050	53	23.80

The only guide the average lathe hand could possibly have would be the cutting speed of the tool guaranteed by the tool-steel makers. Following this lead, he would undoubtedly run either 43 or 53 per minute cutting speed, thereby increasing the machine time for this cut from 60 to 120 per cent. over the minimum time. Taking for granted that the operator desired to use the best combination, what data would he have to accomplish this aim?

Tradition is the greatest drawback to any progressive movement. For years tool-steel salesmen have boasted of the blue chips their steel would make by running at excessively high speeds. This stock in trade has been swallowed, line, hook and sinker, by practical men, who should know that a high cutting speed means nothing without a corresponding amount of feed.

After years of costly and painstaking experiments, Mr. Taylor has offered his discoveries to the mechanical public. Many have refused the opportunity of increasing shop production by their bigoted determination to stand pat on antiquated methods. With them the rule of thumb has the call on the rule of reason. By having a standard method and combination of speed and feed, the necessary information is at the disposal of every man who has the operation assigned to him.

In the construction of this card it will be noticed that each item is considered separately. It would be manifestly unfair to the operator to give him the total time only for each piece. To set a fair rate, each detail must be analyzed and the time allowed accordingly. The tools to be used should be specified, as well as the speed and feed combination. The time shown after each element is a guarantee to the man that everything has been considered and allowed for.

This may sound ridiculous but it is open and above board. There is no stacking of the deck for the benefit of the employer. Each item can be challenged by the man or his foreman.

Admitting it is working to a fixed schedule, what efficient organization does not? The more positive and concise the schedule, the more efficiency is shown.

An Instruction Card Should Be the Product of Several Men

The instruction cards issued are not necessarily the creation of any particular man. The tools and handling time are standard, the latter obtained from actual time studies, and the methods very often in part suggested by the operators or their foremen. The ideas suggested, when thoroughly tried out and found superior to those in use, are incorporated as the standard method until a better one is found. In every group of mechanics, each has one or other mechanical traits superior to the others. By a close study of the man these traits can easily be recognized.

On the other hand, each mechanic has one or more weak points. These may not be known by the man himself, or by a casual inspection of his methods, yet they exist and any man following a well planned instruction card can have his weaker points strengthened, as the card should be distinctly educational in its nature.

If an operation is to be correctly standardized, the collective card should be built from the detailed methods of those who excel in one particular line: Thus, the summary of the operation may be the creation of several men with the best ideas of each incorporated into the "one best way."

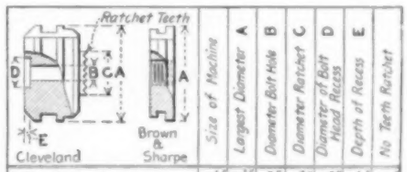
A card built up on these lines, not written for personal aggrandizement or with the intention of pushing the operators beyond human endurance, but with the determination of having the best way regardless of personal views, will fulfil the office it is intended for, that of instructing the operator as to the correct method. Looking at the humanitarian side of the question we must admit that all men are not born free and equal. Some men have been fortunate enough to secure a fair education, while others were forced into the shops at a premature age. The method of instruction during their apprenticeship has made some more resourceful than others, the higher order of mental and physical faculties places some men in a superior position for solving the shop kinks than their less fortunate comrades. Under the old regime of shop management it is unfair to expect all men to be equal producers, as they have not had equal opportunities for advancement.

To expect uniformity of work and time each workman must be started on an equal basis, and to date the instruction card is the best known manner of abridging the existing inequalities. With each man started on an equal basis regardless of his length of employment, any superior ability can readily be noticed, and rewarded acordingly. The fixed schedule in the guise of an instruction card is undoubtedly a strict taskmaster, but it insures a fair deal to all, and recognizes no favorites.

Circular Form Tool Data

By H. M. Spross

The table herewith gives data pertaining to circular-form tools for Brown & Sharpe and Cleveland automatic machines and is arranged in a way that I have found very useful. It may be of interest to other American Machinist readers.



			Size of Machine	Largest Diameter A	Diameter Bolt Hole B	Diameter Ratchet C	Diameter of Bolt Head Recess D	Depth of Recess E	No Teeth Ratchet
Cleveland	Turret	Machine	2½"	3⅛"	7/8"	1⅝"	1⅜"	⅛"	34
"	"	"	2"	2⅝"	5/8"	1⅜"	1⅛"	1/16"	34
"	"	"	1½"	2⅜"	5/8"	1⅜"	1⅛"	1/16"	34
"	Plain	"	1½"	2⅜"	5/8"	1⅜"	1⅛"	1/16"	34
"	Turret	"	1⅞"	2⅜"	5/8"	1⅜"	1⅛"	1/16"	34
"	"	"	5/8"	2⅜"	11/16"	1⅜"	1⅛"	1/16"	31
Brown & Sharpe	"	"	No1	2½"	7/8" x 11 Threads				
"	Automatic	"	No2	3"	5/8" x 11 Threads				
"	Cut-Off	"	No0	2¼"	½" x 13 Threads				

Data for Circular-form Tools

In making brass castings, if fine material, such as sheet-metal clippings or old wire is to be melted down for future use it is well to form the wire into compact bundles by pounding it into an iron mold as for instance, an old mortar. These bundles, which are known in the trade as "cabbages," are then melted at the lowest possible heat. After the metal is molten it is poured into ingots at as low a heat as possible. Later these ingots are used in the regular mixtures. To pour sand molds it is necessary to have the metal from two to three hundred degrees Fahrenheit hotter than would be necessary to pour it into open ingot molds, and hence the method described reduces the losses from oxidation and the volatilization of zinc.

Cutter Heads for Use in Turret Lathes

By E. A. Ermold

A great saving effected in certain classes of chucking work by the use of cutter heads. Cutter heads having a large number of high-speed tools compared with the single-point tool.

The cutter heads described and illustrated in this article are used with success by the Electro-Dental Manufacturing Company, of Philadelphia, on a large part of their turret-chucking work. The class of work on which this great saving is possible is somewhat different from the average run of machine-shop work.

In Figs. 1 and 2 is shown a large cutter head at work on an iron casting, used as a casing for a motor field. It is used on a Jones & Lamson 2x24-inch flat turret lathe, arranged only for chucking work. It is significant that the makers of this machine are advocates of the simple forged tool. With the use of these cutter heads we have increased the output of this machine on our particular work to at least four times what it was with the single-point tools. This seems such a broad statement, that perhaps I had better explain how this is possible, before going any further.

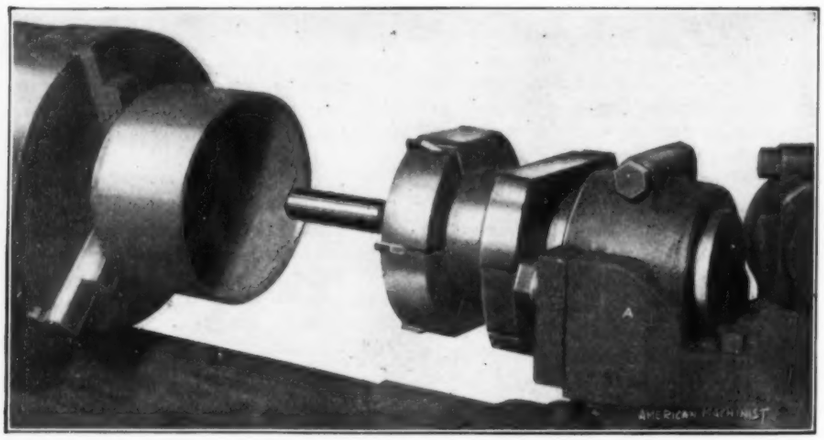


FIG. 1. THE CUTTER HEAD IN POSITION TO ENTER THE WORK

There are a number of features and conditions working together which have made this great saving possible, and I will try and enumerate them in the order of their importance.

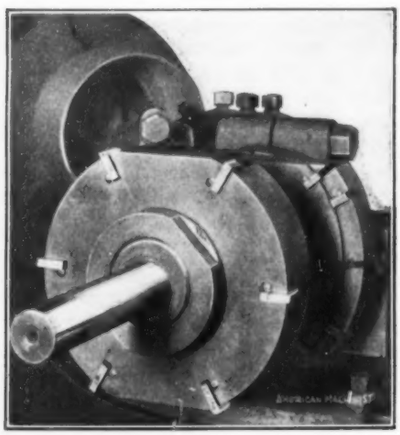


FIG. 2. THE CUTTER HEAD SWUNG AWAY FROM THE WORK

First, the success of the cutter head depends upon the use of a steady bushing in the chuck or fixture or a steady hole in the work itself, and a substintial steady pin in the cutter head, as shown in the different views, Figs. 6 and 7. It is, therefore, obxious that they can only be used on castings with a fairly large hole in the center.

Second, the work for which they are used has a number of narrow shoulders to be bored, the diameters of which must be held close to size, and it is important that the corners of these shoulders should be sharp, as shown at *X* and *Y*, Fig. 5. It should be at once apparent what an advantage the cutter head has over the single-point tool on work of this character. On the other hand, it is also very evident that a casting with a large flat surface to be faced does not lend itself to this system, but must be done with a single-pointed tool, using the cross-sliding head.

A very important factor in the output of a machine is the amount of time it is idle, and a large part of this idle time is occupied in setting up. In the four years we have had this machine, we have never had an operator who could set up in a reasonable length of time. But with the cutter heads—on a large part of the work—the machine is practically set up when the cutter head is placed in the machine, for with the use of the adjustable holder shown at *A*, Fig. 1, the pilot pin can be centered in the steady bushing in a few minutes, and as only one stop need be set for any number of shoulders, the setting-up time is reduced to an almost negligible amount. As the machine is speeded only to the point where the cutters will stay sharp for a whole lot of castings, the cutters are ground while the machine is busy on another job. Another point to be observed is the fact that the different dimensions on the work are set by the toolmaker when he grinds the cutters, thus making it possible to use a lower-priced man on the machine.

High-speed steel is another very important factor. With a large number of cutting edges of the very best high-speed steel, we are able to bore and face a casting in *one* cut, instead of the usual roughing and finishing cuts, the high-speed steel cutting the scale in a manner that is marvelous. It is readily seen what a saving is effected by taking only one cut on a casting, as shown in Figs. 1 and 5, where it takes about 8 minutes for the cut to run up.

Sometimes it is necessary to face or bore, what may be called an interrupted cut, as, for example, the inside of the casting shown in Fig. 5, there are four ribs to be machined. The actual surface is only one-eighth of the whole, therefore a single tool would be working only one-eighth of the time, but with the six cutters at work six times the work is done in one revolution if the feed is increased

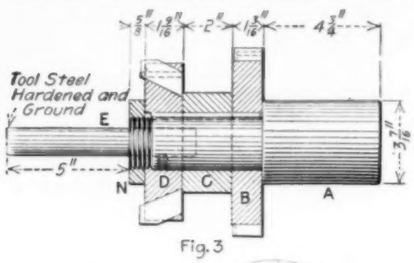


Fig. 3

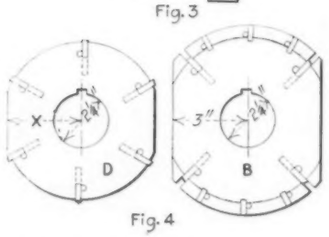


Fig. 4

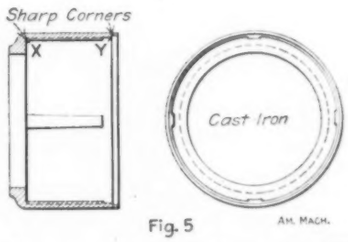


Fig. 5

DETAILS OF CUTTER HEADS AND WORK

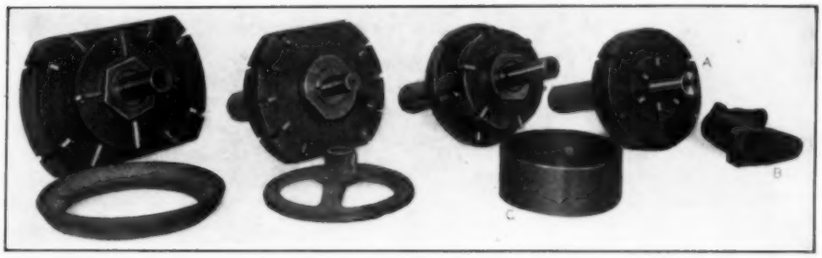


FIG. 6. CUTTER HEADS AND SAMPLES OF WORK

accordingly. Another case of an interrupted cut is shown in Fig. 6. The bottom of casting *B* is faced with cutter *A*, and it will be noticed that the cutters are staggered so as to avoid chatter, as the surfaces are rather wide, one cutter taking a little more than one-half the width of cut.

CONSTRUCTION OF THE CUTTER HEADS

At Fig. 3 is shown the details of the cutter head shown in Figs. 1 and 2. It consists primarily of the central spindle *A*, the tool holders *B* and *D* and the pilot pin *E*. The spindle *A* is made from machinery steel, turned to a shoulder, with a thread for clamping the nut *N* and a hole for the steady pin *E*. The cutter holders *B* and *D* are of cast iron, and are made separate to simplify the construction and to facilitate grinding, which operation can be done either singly or after assembling on the spindle. They are held from turning on *A* by a substantial key.

An end view of *B* and *D* is shown in Fig. 4, showing the spacing of the cutting tools. A very important detail is the manner of slotting, as shown in *D*, Fig. 3. This is the part that does the boring, and as the diameter must be maintained, the bottom of the slot is milled at an angle, thus advancing the cutter in both directions when being adjusted for grinding. For fastening the cutters a straight round pin is used, with a flat milled tapering on it; the hole for the pin is drilled at an angle, after which the slot is milled. Attention is called to the dimension *X* in Fig. 4, which should not be greater than will allow the cutter head to clear the rear of the turret slide when the turret is revolved.

Another very important consideration when using cutter heads is the manner of holding and driving the work, for it is obvious with so many cutters at work at one time that considerable force is required to turn the work. If the work is fairly heavy and it is possible to grip it on a large diameter, the friction is sufficient to drive it. Sometimes it is possible to drive from a lug on the casting. The casting at *C*, Fig. 6, is driven in this manner, although the lug does not show very plainly in the photograph. Some castings require a special chuck or fixture to hold them rigidly enough. An example of this is shown at *A*, *B* and *C*, in Fig. 7, and the line engraving in Figs. 8 and 9. The part to be machined is a brass casting, and it is necessary to grip it close to the ends, as shown in Fig. 8. In order to grip it without springing it, the self-centering chuck jaws were designed for the chuck shown at *B*, Fig. 7, and also in Fig. 9. The jaws are merely round bushings with conical seats in one end and slotted almost the entire length to enable them to be expanded when the nut is brought down.

In operation the castings—which have previously been straightened and formed uniformly between a pair of dies in a large power press—are located by placing the boss, which is on the back of the casting, in a hole in the chuck. The jaws are tightened by gradually bringing the nuts down with the fingers. The round jaws are normally a loose fit in the hole, and the pair of jaws, together with the bolt and nut as a unit, is free to adjust itself to the casting. A wrench is then applied to the nut and the pressure on the conical seats expands the jaws against the body of the chuck, thus locking them without undue strain on the casting.

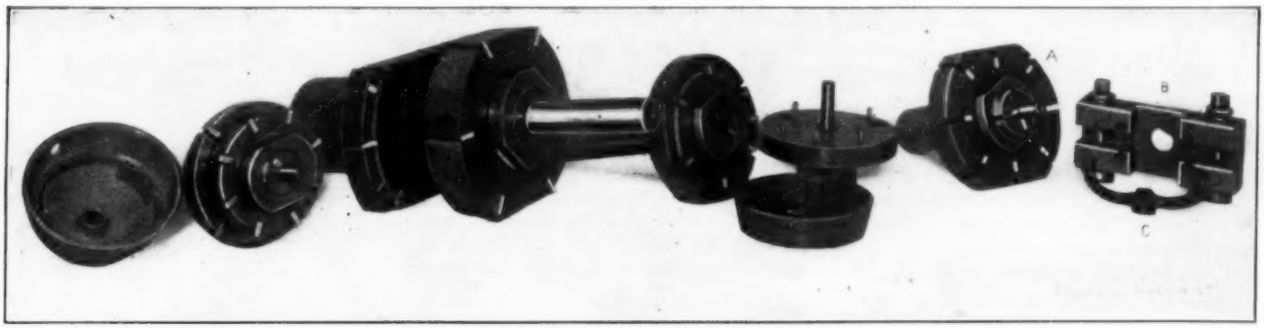
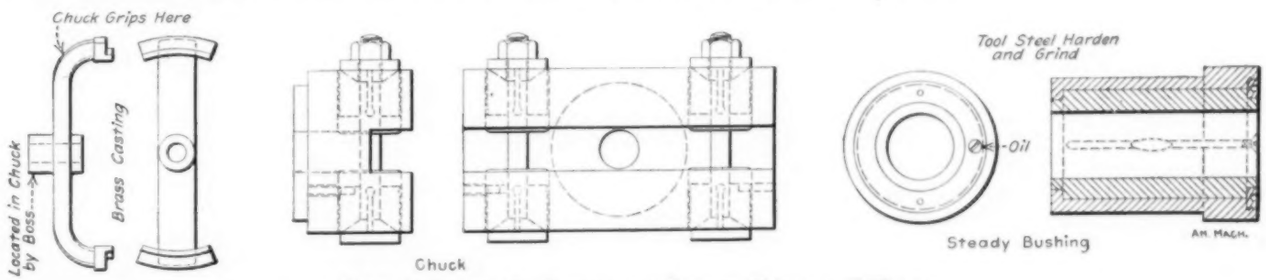


FIG. 7. CUTTER HEADS, WORK AND CHUCKS

Another important detail which must not be overlooked is the construction of the steady bushing. To be effective the bushing must be a good fit on the pin, but as dust and dirt are bound to get between them when at work, they are liable to get stuck, and if the bushing is forced to turn on the pin a considerable amount of damage is often done when this happens. In order to overcome this trouble, the double bushing, shown in Fig. 10, was made. This construction effectually prevents any damage being done if the pin were to tighten in the bushing, as the turning force is not applied to the pin, and the pin merely prevents the turret from feeding, which thereby sounds an alarm.



FIGS. 8, 9 AND 10. DETAILS OF CUTTER HEADS AND WORK

Pulleys for High Speed Belts

By Karl W. Knorr

Slippage with high belt speed is not due to an air cushion being drawn between belt and pulley but to the action of centrifugal force which stretches the belt and tends to make it rise off the pulley face.

It is well known among those who have had experience in operating belts that when the belt speed is high, difficulty is encountered in maintaining the proper speed ratio between the driving and driven pulleys. The speed of the driven pulleys falls below what it should be according to the figures obtained from the formula commonly used for figuring pulley speeds.

As the correct operation of any machine is dependent upon its running up to speed, this lagging of the driven pulley behind its figured speed causes considerable annoyance, to say nothing of loss in machine efficiency. It is particularly objectionable because there seems to be no rule by which just the proper allowance for lagging can be made, thus bringing the machine to the right speed, notwithstanding the slippage. Then, there is, of course, the matter of lost power to consider.

There has been more or less difference of opinion regarding the cause or causes of this slippage, for so it must be termed, and a number of theories have been advanced in explanation. The one which has gained the most general credence is based upon the observation of the fact that when a belt operates at a high speed it seems to leave the driven pulley so that it is often possible to see between the belt and the pulley.

According to this theory the high speed of the belt causes air to be drawn in under the belt, forming an air cushion between the pulley and the belt, upon which the belt rides, skimming around the pulley instead of coming into close contact with its face. This theory holds that the rotation of the pulley is due to the friction between this revolving air cushion and the face of the pulley.

If this theory is correct, obviously the solution of the whole trouble is to do away with the air cushion, which prevents the belt from coming into close contact with the face of the pulley.

It would seem that the easiest way to accomplish this would be the introduction of a small deflecting shield in front of the pulley, and so placed that the belt would just pass without touching it. If any air current existed this deflector would surely break it up and prevent its going under the belt, which it does according to the theory. If this method has even been suggested, it does not seem to have gained any foothold.

The most popular method of doing away with this so called air cushion is the use of pulleys the rims of which are perforated to permit the air to pass through, or grooved circumferentially to permit the air passing out under the belt. A number of manufacturers make and exploit these perforated and grooved pulleys, but they do so probably because there is a demand for them rather than because they believe there is any real merit in the idea.

For a cushion of air to force itself between a belt and the pulley over which this belt operates, it must have sufficient pressure to overcome the pressure of the belt on the pulley produced by the initial belt tension and the load tension.

In the character of service where high belt speeds are more generally used, viz., motor and generator work, both the initial and the load tensions are, as a rule, very high, so that the air must be under considerable pressure to lift the belt from the pulley.

For illustration, take a 10-inch belt running over a 16-inch pulley. An initial tension of 40 pounds and a load tension of 60 pounds per inch in width of belt is a modest assumption, for in practice the figures will run nearer 60 pounds initial tension and from 90 to 120 pounds load tension. However, for illustration, it is desirable that the figures be conservative rather than high. Taking the figures assumed, it will be seen that the total pressure on the pulley per inch in width of belt is 140 pounds, this being the sum of the 40 pounds initial, the 60 pounds load tension on the tight side of the drive, and 40 pounds initial tension on the slack side of the drive. The belt is 10 inches wide, so that the total pressure of the belt upon the face of the pulley is 1400 pounds, and as the projected area of the pulley is 160 square inches, the pressure of the belt per square inch of projected area is 8¾ pounds.

In order to form a cushion under the belt, the air must not only overcome this heavy pressure, but it must also have sufficient extra pressure to produce the added tension necessary in the belt to straighten out the catenary curve in which it hangs, and by thus reducing the sag permit the belt to ride on the surface of the cushion, or the extra pressure must be sufficient to stretch the belt enough to allow it to ride on the cushion. The cushion of air has the effect of increasing the diameter of the pulley so far as the belt is concerned, and its presence, therefore, necessitates an increase in the tension of the belt, reducing its sag between the pulleys, or causing a stretching of the belt.

The tension necessary to produce either of the results mentioned is considerable, so it will be readily seen that the pressure of the air forming the cushion must be extremely high.

If the belt will produce a current of air on its under side which will attain the extremely high pressure necessary to produce the results claimed, why will there not be a similar stratum of air on the other side of the belt? That this is not the case is shown by the absence of results which would accompany a stream of air at from 9 to 12 pounds pressure per square inch, and of a width equivalent to that of the belt. One would not have to get very close to such a stream to be made fully aware of its existence.

It would seem fair to assume that if the current of air under high pressure does not exist on the outside of the belt it does not exist on the inside; but even if it does, it is difficult to conceive why this current will not rush out sideways when it strikes the face of the pulley, taking the line of least resistance instead of overcoming all the resistance offered by the belt and going under it.

Then, too, if the air does go under the belt, why will it run through holes or grooves made in the rim and not out the sides of the belt?

Another point which seems strange is that the cushion always forms on the driven pulley. If the current of air exists, would it not perform in the same way on the driving pulley as on the driven?

A consideration of the effects of centrifugal force develops what would seem to be a rational explanation of the phenomenon. The stretching of the belt is due to centrifugal tension, the belt coming in contact with the driven pulley at frequent intervals, thus driving it, but jumping away frequently enough to produce the illusion of running on air.

There is no question of the existence of such a tension to figure the amount of which Rankine gives the following rule: If an endless band, of any figure whatsoever, runs at a given speed, the centrifugal force produces a uniform tension at each cross-section of the band, equal to the weight of a piece of the band, whose length is twice the hight from which a heavy body must fall, in order to acquire the velocity of the band.

In the case of a leather belt, this ten-

sion produced by centrifugal force can be expressed by the formula

$$T = 0.012\ V^2,$$

where T equals the centrifugal tension per inch in width of belt, and V equals the velocity of the belt in feet per second.

Using this tension and a fair average value of the coefficient of elasticity of leather, the formula for the stretch of leather belting assumes the form

$$S = 0.00000049\ L\ V^2,$$

where

S = Stretch in inches,
L = Total length of belt in inches,
V = Velocity of belt in feet per second.

That the trouble is due to the stretching of the belt produced by centrifugal tension is borne out by the following:

The lower the belt speed the lower will be the centrifugal tension, and, consequently, the less will be the belt stretch. It is, therefore, necessary that the belt be kept up to speed if there is to be any stretch due to centrifugal tension so the belt must necessarily hug the driver closely and the stretch, if any, must all be evident at the opposite end of the drive. This agrees with observed facts.

As the centrifugal tension is reduced with the speed, it is probable that there should be a speed below which the tension will not be sufficient to produce objectionable results. It has been found in practice that if belts are run at speeds not exceeding 4500 to 4800 feet per minute, no trouble is experienced on account of undue slippage.

If centrifugal tension causes slippage, the clearance between the driven pulley and the belt should increase with the speed of the belt. This has been observed to be the case in practice.

Also, if this trouble is due to increased length of belt due to centrifugal tension, it should be possible, after getting the belt up to speed, to eliminate the clearance between the belt and the driven wheel by backing the latter up to the position maintained by the belt. This is also true in practice. Of course, when the belt is stopped and the centrifugal tension eliminated, the driven wheel must be pulled forward again. When the belt stretches it, and when the belt is stopped it tends to regain its original length. If the driven wheel is not pushed forward when the belt is stopped, the elasticity of the belt tending to bring it back to its normal length will produce an enormous pressure on the bearings, and the belt will be under excessive internal strain while at rest. With generators and motors it is no great trouble to run the pulleys back into the belts, or pull the belts into the pulleys, because they are mounted in sliding frames with adjusting screws.

The foregoing is without doubt the real solution of belt slippage with high-speed leather belts.

A means of overcoming the trouble and at the same time doing away with the necessity of moving the pulleys would be to use a belt made of some material which does not stretch as easily as leather. A steel-band belt is being exploited to some extent at the present time, and considerable success in operation is being claimed for it. As steel will stretch only about one-thousandth as much as leather under the same tension, it is obvious that a belt made of this material would be better for high-speed service than one made of leather.

Automatic Fish Cleaning Machine

Special Correspondence

The "Iron Chink," an automatic cleaning machine that takes the newly caught salmon and removes the head, tail, fins and entrails; washes the inside and scrubs the outside of the fish, and delivers them to an elevator at the rate of about one a second.

It would certainly seem that there is no problem too difficult for the inventor of automatic machinery provided there is quantity enough of the material to be handled. One naturally looks for refined manufacturing processes in connection with the making of cans of all kinds; but it is something of a novelty at least to find fish being fed through a complicated automatic machine as a part of the process of canning. Yet this is a common sight in practically all of the salmon canneries of the Pacific Northwest, and the "Iron Chink" is a striking example of what can be done in the development of automatic machinery where quantity can be obtained.

It is well known that the salmon fisheries of the Pacific Northwest constitute a very important industry; but it is impossible for one unfamiliar with this industry to fully comprehend its enormous scope and volume. There are many canneries on the coast but the group of canneries at Anacortes, on Bellingham bay, in the State of Washington, is perhaps the most important, and will serve best to show the numbers in which these fish seek the inland waters at certain seasons of the year, and also the gigantic task which these canneries must perform in a very short period of time. The seven canneries located at this place can pack fully 20,000 cases of canned salmon daily, 48 one-pound cans to the case. This requires 24,000 salmon delivered at the canneries every day during the fishing season; and as the average weight of a salmon is about 6⅓ pounds this means a daily delivery of about 750 tons of fish. To handle this great quantity through all the processes of canning involves many interesting operations and some ingenious machinery; but by far the most ingenious machine employed is the Smith automatic fish-cleaning machine, or "Iron Chink," so called because this work was done formerly by Chinamen for whom "Chink" is a colloquial name.

The "Iron Chink"

This machine which is shown in plan, elevation and rear view, in Figs. 1, 2 and 3 respectively, takes the newly caught salmon and removes the head, tail, fins and entrails; washes the inside and scrubs the outside of the fish, and delivers them to an elevator at the rate of about one a second. Strictly speaking the machine is semi-automatic as it requires the services of an operator and one assistant. Figs. 4 and 5 were made from photographs of the new machine.

Referring to Figs. 2 and 3, the base plate of the machine A carries the upper plate B on four steel columns C. These steel columns in turn carry two cylindrical drums $D\,D$, by means of the lugs $E\,E\,E\,E$ so that the drums D are rigidly attached to columns C. Each pair of side columns carries one of these drums, projecting inward, and separated from each other by a short distance on the center line of the machine, as can be seen in Fig. 3. These cylindrical drums D are machined on their outer surfaces, and carry the cylindrical shells $F\,F$ which are bored to fit the outer surfaces of $D\,D$ and rotate upon them. The gears $G\,G$ are integral parts of the shells $F\,F$, and engage with the pinions $H\,H$. These pinions are keyed fast to the shaft I, so that the shells $F\,F$ rotate as though they were one and the same part. Rotation is in a clockwise direction, as seen in Fig. 2.

How the Motions Are Imparted

Motion is imparted to the shaft I by the vertical main driving shaft J, through the gears J'. Motion is also imparted by J through the gears $K\,K$, to the several cross-shafts carried by the upper plate, and clearly shown in plan in Fig. 1. These cross-shafts in turn drive the knives, cutters and other appliances arranged around the central drum, by means of an ingenious system of shafting and bevel

gears; hence these are all positively operated. The main shaft *J*, which is the sole source of energy, is only $1\frac{7}{16}$ inches in diameter and rotates about 500 revolutions per minute; the amount of power consumed is small. The main shaft is geared to the revolving sleeves *F* in the ratio of 40 to 1.

Since four fish are cleaned at every revolution of the drum, this speed of the main shaft (500 revolutions per minute) delivers 50 fish per minute. This has been found to be the most efficient speed, though the machine will operate well up to a capacity of 65 per minute. Below the speed of 50 per minute, the machine is not so effective, on account of the lower velocity of the knives and other attachments.

The main feeding table *L* has an extension *L'* in which are cut four slots. Through these slots rotate the fingers *N*, which are fast to the shaft *N'* which receives continuous rotary motion from the shaft *I* through the gears *O O*. The assistant stands at *R* in front of the extension *L'* (Fig. 1), and the operator stands at *S* (Fig. 1). The cycle of operations is as follows:

The Operation of the Machine

The assistant places the fish on the extension table *L'* with the tail toward the machine. The revolving fingers *N* pick it up and carry it along the guides *P* and against the knife *T* (Figs. 2 and 3), cutting off the head and depositing the body of the fish on the main feed table *L*. The operator turns the fish on its back and pushes it, tail first, into the machine at *Q*, Fig. 1, between the faces of the rotating sleeves *F F*, a stop inside the machine preventing it from going in too far.

Each of the faces of the revolving sleeves *F F* is fitted with gripping pins about one-half inch in diameter, which move parallel to the axis of the sleeves and are operated by rollers that engage with grooves cut in the outer surfaces of the stationary drums *D*. The outer ends of these pins, which face toward the center of the machine, are formed into three-pointed spikes. These pins are set opposite each other in the two revolving shells and there are three pairs of pins in each set. There are four complete sets in the shells, so that four fish are drawn in each complete revolution of the sleeves.

When the first pair of pins, or "tail grips" as they are called, come opposite the tail of the fish, the cams push them into the fish, one from each side, just forward of the web of the tail, and the pins begin to draw the tail upward and around the shells in the direction shown

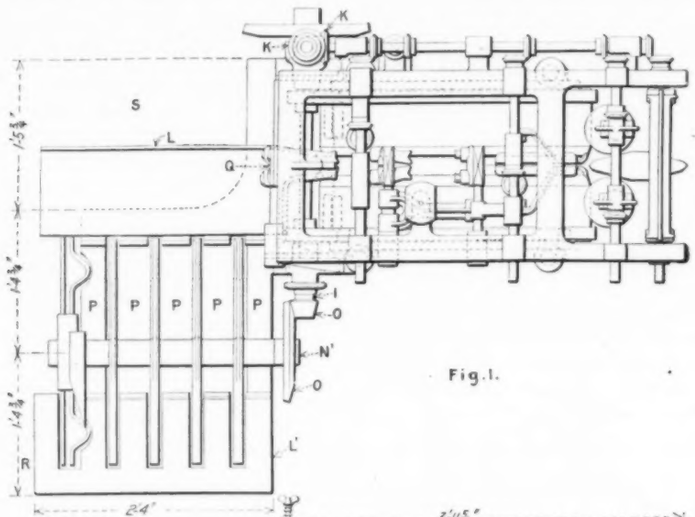


Fig. 1.

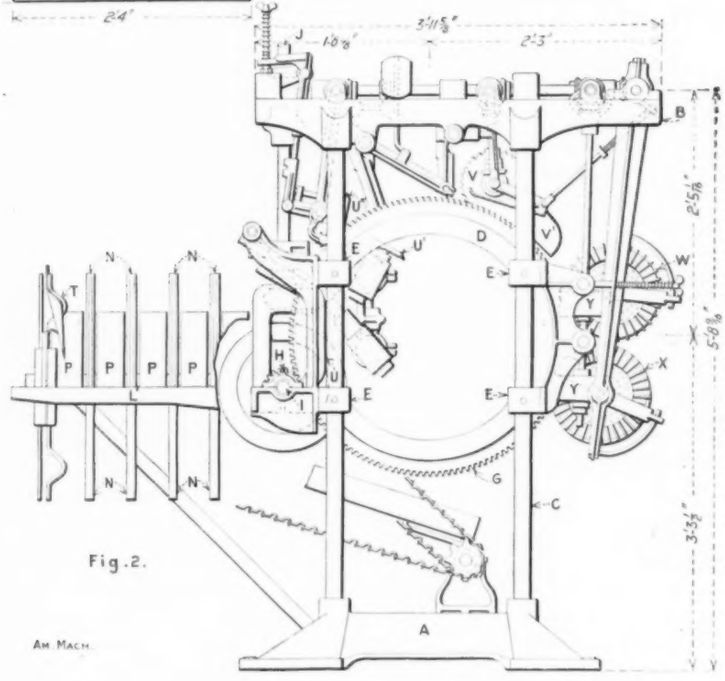


Fig. 2.

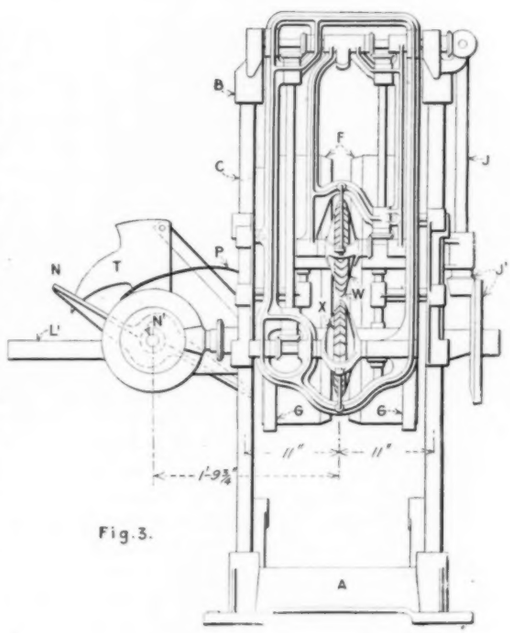


Fig. 3.

THE "IRON CHINK"

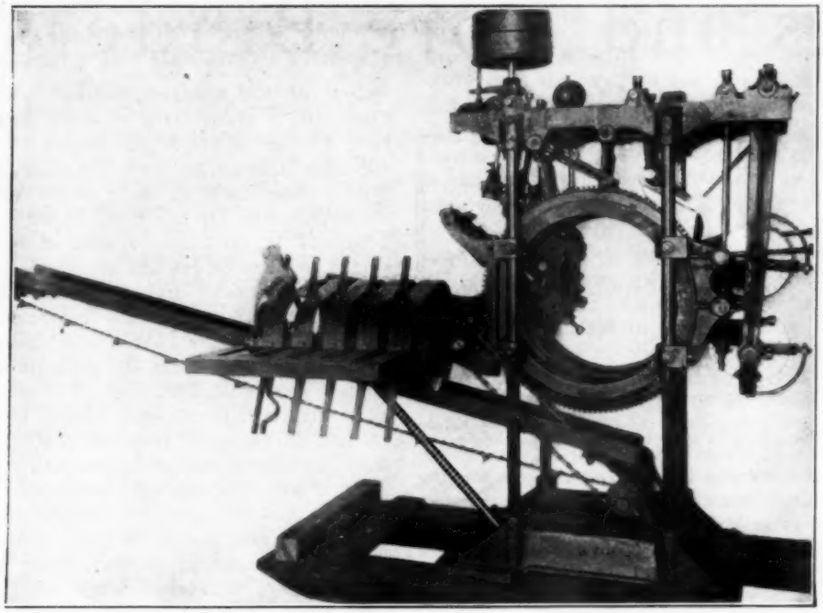


FIG. 4. A SIDE VIEW OF THE "IRON CHINK"

by the arrow in Fig. 2. As the fish moves upward, the other pairs of pins seize it near the backbone, one set taking hold about one-quarter way along the body and the other about half way up.

As the fish begins to move upward and around the sleeves, the tail is first removed by the curious and very effective knives *U*. These double, conical, rotating knives have serrated edges and are perhaps the most important and interesting features of the machine. As the motion continues similar knives *U'* remove the back fins, while other similar knives *U"* remove the belly fins, a most ingenious attachment in front of *U"* gathering these belly fins up in such a manner as to make this operation possible with one knife.

The fish is next run under the "belly-slitting saw" *V*, which cuts it open, and immediately afterward the "spreader" *V'* opens up the fish, spreading the sides apart so that the rotating gutter *W* easily removes the entrails as the fish passes under it.

After the removal of the entrails by *W*, the knife edge in the center of the periphery of the "blood-scraper" *X* cuts the blood sac along the backbone and the scraper removes the blood with the aid of a strong jet of water. While *W* and *X* are at work the sides of the salmon are scoured by the brushes *Y*, which also support the sides of the fish against the action of *W* and *X*. Passing around to the bottom side of the sleeves, the cams withdraw the gripping pins and the fish drops into the elevator under the machine and is conveyed away to other operations. This elevator is also driven by a chain from shaft *I*, so that the machine is completely self-contained.

All of these attachments are driven from the upper plate by bevel gearing. The knives *U* and *U'* are adjusted by swiveling, as can be seen in Fig. 2. The attachments *U"*, *V*, *W* and *X* are swung pendulum fashion from the upper plate by hanging frames (one frame carrying the last two) and are therefore adjustable over a large range. They are held in position, when once adjusted, by helical springs; and hence compensate automatically for a large variation in the size of fish.

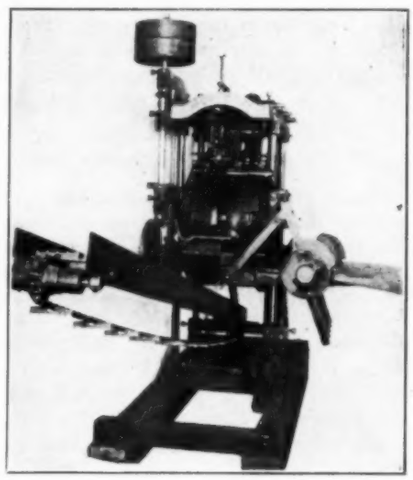


FIG. 5. AN END VIEW

Guards placed before the knives, saw, etc., prevent waste through too deep cutting and as these guards are carried by the swinging frames, they automatically adjust the position of the attachment and depth of cut to the varying size of fish. The work of the machine in this respect is greatly superior to hand work for the adjustment as to depth of cut is perfect, and the fish come from the machine as neatly "barbered" as could be desired.

THE RANGE IS REMARKABLE

The range of the machine is remarkable. There are several kinds of salmon caught in these waters, such as "silver" "humpy," "sockeye," "king," etc., and these vary in size from 18 inches in length and 5 to 10 pounds weight, to 60 inches in length and 70 pounds weight. Yet this machine can handle all kinds, except the very large ones; and as these constitute a very small part of the catch, it has not been found necessary to build the machine in more than one size.

It is interesting to note that the principles which govern the application of automatic machine tools apply also to this machine.

The machine is well built in a workmanlike manner and the material and finish of each part has been carefully planned to meet the trying conditions under which the machine must operate. It is manufactured by the Smith Cannery Machines Company of Seattle, Wash., who kindly furnished the drawings and information for this description.

Convenient Place for Belt Shipper Poles

BY J. A. PHILLIPS

If there is one thing in a workshop that seems to have no special place in which to be deposited when used, or sought for when needed, it is the length of wood used to ship belts up and down the top cone pulleys, of various machines.

This as yet indispensable article, is generally lying on the floor, or is stowed away in some corner, while the operator who is in need of it wastes valuable time trying to locate it.

To obviate this, we had all the columns in our department, drilled and tapped at a suitable hight for the length of poles used, and screwed into each column a ⅜-inch bolt about 3 inches long. Then we bored holes of a size that would pass conveniently over the heads of the bolts in a similar number of poles, some distance from the top, and hung them up.

The results have been excellent, the men very seldom fail to replace them after use, and no one has to go further than a step or two to the nearest column for a shipper pole when required.

Many foundrymen use an iron rod for stirring any kind of brass or bronze alloy, but where this is done more or less of the iron will be absorbed, rendering the metal harder. If it is intended to be prepared for making brass or bronze castings, graphite stirring-rods should be provided. When melting any brass or bronze alloy the metal in the pot should be covered with powdered charcoal; some foundrymen use a fusible flux on top of the metal, as broken glass, borax, or a mixture of soda and sand.

Core Sands and Core Binders*

By H. M. Lane

The important chemical and physical properties of core sands and binders, with an especially complete discussion of the actions of the latter.

*Extracts from a paper presented before the American Society of Mechanical Engineers.

The term core sand covers a wide variety of materials suited to different classes of core work and the conditions to be met in the core room necessitate the use of a number of grades of sand in most core rooms. In all core sands the principal heat-resisting element is silica, the silica grains also forming what may be termed the back bone of the core. Ordinary molding sand rarely contains over 80 per cent. silica, the balance being made up of alumina, oxide of iron, and other impurities. In a molding sand a certain percentage of clay is necessary to form the bond. They may be divided into bondless or sharp sands for oil-sand mixtures or cores which require a great deal of vent; and the bonded sands and gravels. The sharp sands contain from 97 to 98.5 per cent. silica, while the bonded sands, contain from 97 to less than 90 per cent.

Proper Condition of Bond in a Core

Since a core must be sufficiently porous to vent freely, the sand composing it must be of such a nature that there will be a considerable percentage of voids or open spaces through which the vent may escape. In any core the individual grains of sands must be bound one to another with some material, collected, if possible, at the contact points, thus leaving the spaces between free for vent passages. Anything that tends to roughen the surface of the grains of sand in the passages tends to retard the vent.

Form of Sand Grains

In concrete and masonry work sharp sand is desirable on account of the fact that it affords a better grip for the cement or lime in the mortar. For core work rounded grains of sand are the best because they give a maximum of vent passages and larger areas at the contact points for the bonding material to act. The strongest cores that the writer has seen used in practice were made from oil-sand mixtures with thoroughly rounded grains of sand, the individual grains being of approximately uniform size.

In concrete work the object is to fill all the voids between the particles of the material with finer stock, so that the final product will be a uniform solid mass. In making cores the requirement is radically different, as it is desirable to have the greatest possible number of fine voids; only they should be so fine that the metal will not tend to follow or flow into them. This necessitates the use of different-sized grains in the core sand for different metals.

Some of the brass and bronze mixtures are particularly searching and will force their way into cores where iron would lie smoothly on the surface. There are two reasons for this, one that the melting temperature of the brass and bronze alloys is lower than that of the iron mixtures and hence they remain fluid for a longer time in contact with a core; and the other that the iron alloys seem to be more viscous when fluid and will not flow into as sharp corners as the brass and bronze alloys.

Aluminum in some respects behaves like iron in this particular. Sand mixtures which would be perfectly satisfactory for iron or steel or for aluminum may be wholly unsuited for brass or bronze. A brass or bronze containing considerable phosphorus is particularly searching in its action, also an iron containing considerable phosphorus is more fluid than other mixtures and has more of a tendency to cut into a core. From this it will be seen that the selection of a particular grade of core sand must depend to a considerable extent on the metal to be cast.

Kinds of Binders

There are two classes of binders as regards their action on the sand. These are the true pastes, which do not flow to the contact points of the sand, and the binders that flow to the contact points as the drying and baking take place. All binders which act as a paste are not affected by clay in the sand. This is also true of resin and pitch. Binders that partake of the nature of an oil are injured and in some cases ruined by the presence of clay in the sand. The advantages of sharp sands and sands of uniform-sized grains were never fully appreciated until the complicated problems of the water-cooled automobile-engine cylinders required solution. At first intricate systems of mechanically formed vents were used, but later it was discovered that by using clear silica sands and oil as a binder the vent would find ample passage in the spaces between the rounded grains.

Fitting the Binder to the Sand

In selecting the core sand for any given location the problem to be solved is the finding of the cheapest finished core. Cores for a given class of work must have a given strength per square inch and must disintegrate when the metal is poured about them, so as to permit ample opportunity for the metal to shrink. Generally in producing a core of this kind a number of courses are open. A local bonded sand may be used with resin, flour, dextrine, black compound, glutrin, or molasses. As a rule, black compound or pitch cores are more suited for heavy work than for light. For small work greater strength per square inch of core is generally required than for large work, and for great strength associated with free venting there must be a binder that will hold a sharp sand and at the same time permit the free circulation of the escaping gases. Flour or dextrine tends to a large extent to stop the vent, as do also the black compounds, which contain dextrine as a green binder. This calls for the use of an oil mixture, an oil and glutrin mixture, a glutrin and clay-wash mixture, or molasses.

A number of different water-soluble by-products from commercial processes have been or are used to some extent as core binders. In some places in the vicinity of rum distilleries a product known as distillery returns, distillery slop, or sour beer, is used; in other locations sour beer from breweries, but both are employed only in limited localities as they are weak adhesives and hence not good binders.

The principal objection to the use of molasses in the core room is the fact that this binder is not uniform in its adhesive properties. First fermentation has to be dealt with. To test its effect the writer measured out a quantity of molasses, diluted it with twice its volume of water, and let it stand in a crock. The specific gravity of the solution was taken every few days and batches of cores made from it were tested for strength. These fell off rapidly in strength as the fermentation proceeded, losing more than half, and at the same time the specific gravity constantly decreased. Foundrymen have been known to purchase fermented molasses thinking that they were getting a cheap bond. In a case of this kind, however, one has no knowledge of the actual bonding power.

At the time the fermentation experiment was made on molasses a sample of glutrine was measured out, diluted to the same proportions, and allowed to stand in a crock next to the molasses. Cores were made from it each time that cores were made from molasses. Those from glutrine gradually increased in strength with the age of the mixture, due to its slow concentration by evaporation. The molasses mixture was, of course,

evaporated just as fast, but the composition was changing so rapidly from fermentation that the effect of evaporation did not show.

Another objection to molasses is the fact that no matter how honest the dealer or how free from fermentation the stock may be at the time it is used, its bonding power must depend upon the source from which it was derived. In making cane sugar the plant is topped in the field and the tops are thrown away because the juices in the upper part of the stalk have not been converted into sugar. If the stalks are topped too high, a large proportion of the juice carrying no sugar enters the fluid and remains in the molasses after the sugar has been crystallized.

As the molasses is the residuum of the sugar process it must contain all its impurities, and these vary with the source of material from which the sugar was made, the method of work, the way in which the cane was topped, and many other factors.

The only other water-soluble bond extensively used in the foundry is glutrin, a byproduct of paper manufacture by the sulphite process. The sap stored in the cells of the spruce wood used in paper making is extracted by boiling with the sulphite solution and when treated to remove certain undesirable elements, and concentrated, it becomes the binder known as glutrin. While its composition is complex, consisting of tannins, wood sugars and resin in soluble form, it is a product uniform in composition and hence in binding power, and it will not ferment.

Use of the Microscope

It has been found that a microscopic examination of the fracture of a core would tell much as to its venting properties and the efficiency of the bond, but thus far, however, it has proved impossible to produce a microphotograph that would show all that the human eye could see in examination of a core, because the focal depth of the micrographic lenses is exceedingly shallow, so that when examining cores at magnifications of 60 or more diameters, it is necessary to rock the objective back and forth and examine the top, the middle and the bottom of a grain of sand, thus giving a clear mental picture of the bonding conditions. A microphotograph taken in the ordinary way does not show this as it has not sufficient depth of focus.

Action of Oil in Binding Sands

Oil of a proper grade is undoubtedly the strongest and, weight for weight, the most efficient binder known when dealing with clean silica grains. In the paint trade linseed oil is considered the best drying oil, and it is also the best core oil. The action of linseed oil in bonding a core is as follows: The material must be so thoroughly mixed with the sand that every grain is uniformly covered with oil or an emulsion of oil and water. When the heat of the core oven acts on the sand the moisture is evaported and driven off. As the moisture passes through the core toward the outside the oil remains behind on account of its relatively high viscosity and first uniformly coats each grain of sand. By capillary attraction excess of oil tends to accumulate at the contact points of the sand grains and finally dries down here and forms an area of bond somewhat larger than the contact points. The heavier the oil, that is, the more body it contains, the more will the space about the contact points be filleted and the bonding area increased. Most of the other drying oils contain less body than linseed, and hence do not give so firm a bonding mass at the contact points as is the case with linseed. All oil-sand mixtures must be tempered with water.

Action of Paste in Binding Sand

The radical difference between the the bonding of sharp sand with an oil and with flour or dextrine is that the latter forms small masses or grains of paste which dry on the face of the sand grains. These do not flow over it to the contact points, but dry in the place where they were left by the mixing machine. For this reason only those situated at the contact points become efficient as a binder. A microscopic examination of a flour or dextrine-bound core shows that certainly not less than 60 per cent. of the material is inactive as a binder and is located in such a way that it tends to block the vent passages by giving the grains of sand a rough instead of the smooth varnished surface given to the grains by oil.

Action of Resin and Pitch in Binding Sand

Resin and pitch both bond sand by melting and flowing over or between the grains, collecting to a certain extent at their contact points as the core cools, but they are not so efficient as is oil. Resin and pitch do not enter into combination with clay, but their binding power is added to whatever power the clay may have. When such a core comes in contact with the molten metal in the mold, the carbon material of the resin or pitch is burned out, which disintegrates the core, thus making it possible to clean it from the casting; while if clay or natural bond alone were depended upon the bond would be hardened instead of softened, and it would be impossible to clean it from the casting.

Action of Molasses in Binding Sand

The action of molasses in a core depends upon the rate of drying and the temperature. Under ordinary core-oven conditions where the cores are put into a hot oven, the water is quickly expelled and the molasses brought to the boiling temperature. When it reaches the consistency of ordinary molasses candy, it boils up in a similar manner and then hardens in thin plates connecting the sand grains with a more or less intricate system, and with the carbon exposed in exceedingly thin surfaces, though, of course, some of it dries at the contact points. If the core is taken from the oven at the critical point just as these plates are in their strongest condition, it will be found to be strong and serviceable; but if taken out too soon, it will have developed sufficient strength to give a strong core, and if left in the core oven a little too long the carbon will have become rapidly oxidized and the strength of the core will fall off. For these reasons a molasses core is exceedingly sensitive and with ordinary existing core-oven conditions it is practically impossible to produce uniform results.

Action of Glutrin in Binding Core Sand

The compounds contained in glutrin are of such a nature that they do not enter into and combine with clay as does oil, but they do form with it an exceedingly efficient emulsion and tend to carry it from the faces of the sand to the contact points. In drying, glutrin behaves more like oil, in that it tends to flow to the contact points.

In sharp sand without any clay bond the fact that glutrin lacks the viscosity of linseed oil, gives it a tendency to follow the moisture to the surface of the core. In a mixture of clear, sharp sand, a glutrin core will tend to have a very hard skin and a soft interior. This is well illustrated in the microphotograph shown in Fig. 11, which is a core made with clear Rockaway Beach sand and glutrin in the ratio of 1 part of glutrin to 50 parts of sand. The glutrin tended to sweat to the surface of the core, giving a hard surface, as shown by the darker material along its face. The main body of the sand was bound fairly well, but this dense layer on the outer surface interferes with the escape of the steam from the interior toward the latter part of the drying operations and may result in an imperfectly dried core. Attention is called, however, to the exceedingly open character of the core itself.

This sweating tendency is entirely overcome by introducing from ½ to 1 per cent. of clay into the mixture, the clay and the glutrin together forming a compound which is sufficiently viscous so that it draws to the contact points rather than following the moisture to the surface of the core, making it strong and at the same time one which does not have the vent passages stopped. Glutrin can also be used in connection with oil in clear sand mixtures, as the oil prevents it from sweating to the surface of the

core and the combination blends perfectly to form an efficient bond at the contact points.

Reactions between the Sand and the Binder

A quantity of gangway sand was shipped to the laboratory at Covington, and, together with the other sands that had been giving trouble in different parts of the country, a series of experiments was started. From the behavior of these sands it was evident that some action was going on which destroyed the binder, other than the mere absorption of it, which takes place when the oil unites with clay and is rendered inoperative.

To test the correctness of this theory a batch of gangway sand and a batch of Michigan City sand were measured and placed in two bottles. As glutrin was wholly water soluble it was chosen as a binder. Three equal batches of glutrin were diluted with a given amount of water. One was placed on the Michigan City sand, another on the gangway sand and the third held in reserve. After leaving the binder several hours each sand was leached with water until all the binder was washed out. The two batches of glutrin were then concentrated by boiling to expel the excess water. They were brought to the same volume as the batch held in reserve, and three sets of cores made, one from the glutrin which had been on the gangway sand, one from that which had been on the Michigan City sand, and the third from that which had not been on any sand.

There was very little difference in the strength of the cores from the second and third batch, but the cores made from the glutrin which had been on the gangway sand were not one-fourth as strong as the others, showing that the sand had destroyed the bonding power of the glutrin. A few tests soon showed that it was alkaline and the addition of a small amount of acid destroyed the alkalies.

Following up this clue, two batches of cores were made from gangway sand, in one case the sand having been treated with acid to neutralize the alkalies and in the other it was left in its natural condition. The acidulated sand produced cores more than four times as strong as the other batch. Continuing the investigation, experiments were made by treating with acids a number of sands giving poor results with different binders and it was found that neutralizing the alkalies with acids increased the strength of the cores greatly. This is true both in the case of glutrin and oil.

Since these experiments the subject has been taken up with a number of foundrymen and several exceedingly interesting cases brought to light. In one instance a foundry was purchasing city water of a very pure grade at a relatively high cost. To avoid this expense an artesian well was sunk. Immediately trouble appeared. The cores cut and washed and it took some time to trace the difficulty. Finally the city water was again used and the trouble disappeared. The water from this well was clear, sparkling and tasted good, but it was high in lithia salts and evidently contained ingredients which combined with the binders to destroy them.

Alkalies tend to saponify oil, thus destroying its bonding power. They also seem to act on resin, glutrin, and some other binders. In the case of the large manufacturing concerns using a great many oil-sand cores it would probably pay to purify the water for the core room just as the feed water is purified for the boilers.

Determining the Active Bond in Clay

Formerly when a chemist received a sample of sand for analysis he determined the alumina, figured it as kaolin, and called it "bond." From various results with bonded sands it became evident that this free and easy method was not sufficient, and some way of differentiating between a fat and a lean clay had had to be found. Several firms and different departments of the Government were making use of a test for colloidal matter. Chemists have long recognized a series of amorphous bodies known as colloids, or as one noted chemist writing in popular vein recently says, what in the laboratory are called "messes."

When matter is in one of the colloidal forms it has intimately associated with it a large amount of water, forming what is termed a "gel." The soluble colloids are called "sols." Certain clays are far more plastic and have greater binding power than others, and it has always been known that heat destroyed this binding power. It is now certain that in these clays at least a portion of the alumina is in the colloidal form. For decades the best clays have been found in the secondary deposits where they had been associated with organic matter, but these properties have been found even in the old fireclays of the coal measures. When first exposed these are in a compact form, much of the water having been expressed or driven out by pressure, and when exposed to the weather they absorb moisture.

The only test for colloids of which there is any record is the one used by several departments of the Government and a number of firms in this country, and is founded on experiments carried on in Germany.

The aniline dye known as malachite green is used for this purpose. A given amount of malachite green is weighed out and dissolved in 400 or 500 cu.cm. of water. Into this from 10 to 20 grams of the sand or clay to be examined is introduced and the whole is shaken in a shaking machine for an hour. The bottle containing the material is then taken out and the solid matter allowed to settle to the bottom. A portion of the liquid above the solid matter is drawn off, placed in a color tube, and compared with the dye diluted with the same amount of water which was used in making the original solution.

The behavior of many of the sands tested when made into oil-sand cores showed very conclusively that the dye test gives a good idea as to the amount of oil which would be destroyed by the sand. Apparently the dye reading gives not only the colloidal matter which will destroy the oil, but in the case of old or burnt sands gives a fair indication of the amount of alkali or other material present which would destroy the oil. This was noted in connection with the gangway sand from Moline. Further tests will be made along the line of examining sands and studying the relationship between the natural bonding power and the colloidal reading as given by the dye tests. Thus far this seems to be the best test found.

Name	Dried 24 Hours at 212 Deg. Fahr.	Dried 1 Hour at 400 Deg. Fahr.	Dried 1 Hour at 410 Deg. Fahr.	Burned to Ash	Remarks
Glutrin	51.47	41.98	.....	8.03	Skin
Raw linseed oil	100.22	96.98	95.22	0.22	No skin
Boiled linseed oil	93.49	90.23	.....	0.54	Skin
Soya bean oil	100.91	96.45	94.26	0.65	No skin
Fish oil	100.52	92.70	91.25	1.20	No skin
Paraffin oil	72.05	33.36	10.40	0.11	No skin
Corn oil	100.72	95.35	93.12	0.42	No skin; crawled
Cottonseed oil	100.68	96.08	94.10	0.07	No skin
Light tar oil	31.18	11.65	.....	0.09	Slick crawled
Heavy tar oil	67.21	38.27	.....	0.06	No skin; crawled
Resin oil	62.89	19.59	.....	0.06	No skin; crawled
Crude tar oil	51.83	34.32	.....	0.06	No skin; crawled very much
Resin oil	63.64	10.12	.....	0.03	No skin; crawled
China wood oil	102.20	98.75	.....	0.03	Skin

DETERMINATION OF SOLIDS IN LIQUID CORE BINDERS

Action of Other Binders on Oil

When an oil is used as a bond it is not only destroyed by any clay or colloidal matter present but may also be destroyed by other ingredients used as binders. Where green strength is required in a core, foundrymen frequently introduce flour or dextrine into oil-sand mixtures. The oil first combines with the flour to

form an oil-flour paste which has very little bonding power, but when so held it is not in a position to act as a binder between the sand grains. In consequence what happens in a mixture of this kind is that a portion of the oil unites with the flour and is itself destroyed for binding purposes. At the same time it renders the flour less efficient than it would be had it been mixed with water. The balance of the oil can act in its usual manner between the sand grains.

Testing Binding Power of Liquid Binders

The final binding power of any compound is measured by the solid bond left in the baked core. Paint chemists test their oils by drying them down to a film and seeing what percentage of weight has been lost in this action. In the accompanying table the binders shown in the column at the left were each weighed out into porcelain crucibles and first placed in an air bath and subjected to a temperature of 100 degrees Centigrade or 212 degrees Fahrenheit for 24 hours and then weighed. These results are entered in the second column. The crucibles were next placed in the core oven at a temperature of 400 degrees for 1 hour and again weighed and the results indicated in column three. Some of the crucibles were then returned to the core oven for another hour, exposed to a heat of 410 degrees cooled, and again weighed and the results recorded in the fourth column. The samples were then all heated in the air over a blast lamp to burn off the carbon, and the percentage of ash is recorded in the fifth column.

Under the head of Remarks a statement is given as to the behavior of the liquid. Most of it dried down to a skin. The first exception to this was raw linseed oil, and the reason was that even when painted as a film on wood it takes at least 4 days for it to dry. There was evidently not a sufficiently free admission of air in the oven to dry down the bulk of oil in the crucible.

A Railroad Shop in Cuba

By Fred H. Colvin

Keeping the locomotives of the United Railroad of Cuba in condition for regular service and preparing them for the big crop of cane and sugar.

English and American machine tools that are doing good work, nearly all of the newer machines being American.

The Cienga shops of the United Railways of Havana are located just outside the city of Havana, and are the main shops. Since its coalition with the Havana Central and the other roads which make a rather complete network on the western end of the island, these shops are kept busy. The cane-grinding season usually begins in December and means a heavy demand for cars and power just as the wheat crop does in the West. This year, owing to the high price of sugar, there is a tendency to begin grinding as early as possible as is quite natural.

These railways are largely owned by English capital and much of the machine equipment came from British shops. Some of it came over a long time ago and is antiquated, while others are quite modern and there are some American tools, the latest addition being a fair-sized Cincinnati planer.

Many of the locomotives are English, the remainder being mostly from the old Rogers shop at Paterson. I am told they have one of the old Roger, Ketcham & Grosvenor locomotives in an out-of-the-way round house, which bears the date of 1844.

The Personnel

The present superintendent of motive power and rolling stock is familiarly known as Ben Johnson, all over the West, Southwest and in Mexico, and a more genial host has yet to be invented. Incidentally I found that he was a classmate of our editor emeritus, and he certainly was good to me and to the American Machinist. Master mechanic Bonnefield and car builder Elliot were particularly cordial, while mechanical engineer Reilly kindly acted as interpreter for me on several occasions and prevented me ordering the wrong things to eat and drink.

As is very apt to be the case on a road of this kind, the rolling stock had gotten into rather bad ways and they are just bringing it up to standard by hard work through all the summer months, getting ready for the sugar business.

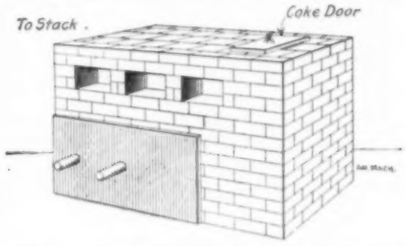


Fig. 1. The Heading Furnace Using Coke

Locomotives have been thoroughly overhauled, given new flues in many cases, at a comparatively low cost by an efficient flue-welding plant which has been installed. This consists of a rather unique furnace which does away with the clogging up of grates and alows a constant run from morning till night. Coke is used without grates, being dumped in at the top of the furnace and resting on the ashes at the bottom, raking out the ashes when necessary being all the at-

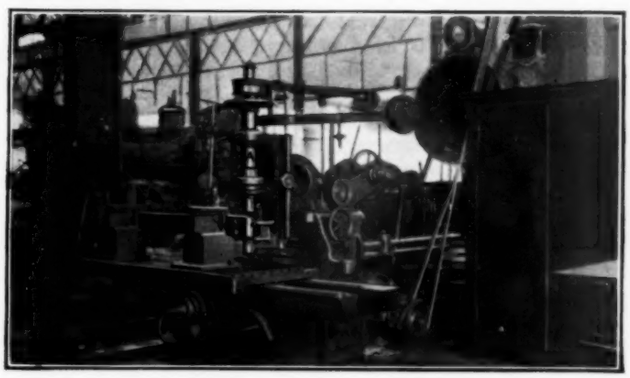


Fig. 2. Vertical-spindle Guide Grinder

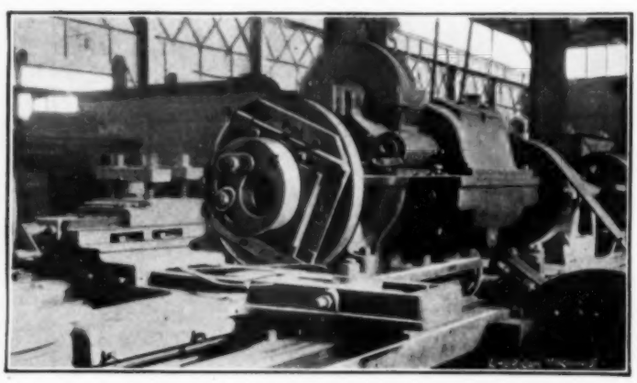


Fig. 3. Handy Chuck for Turning and Boring Eccentrics

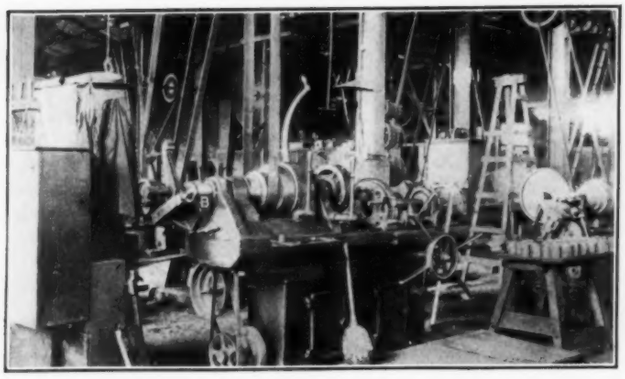


FIG. 4. OLD ENGLISH FOX TURRET LATHE

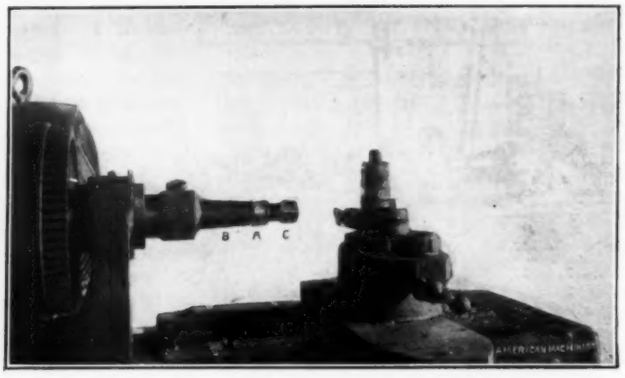


FIG. 5. MAKING FERRULES FOR BOILER FLUES

tention required. The heat goes up and through the horizontal furnace chamber, which has three openings for flues.

Flue ends are prepared and then heated in the first opening, butted together on a suitable mandrel directly in front of the furnace, heated again and going to a rotary flue welder at the right, which finishes the job in short order. Fig. 1 gives an idea of how this is arranged.

GUIDE BAR GRINDER

One of the interesting machines, and one which is giving the best of satisfaction, is the guide-bar grinder shown in Fig. 2. This was built by Alfred Herbert, of Manchester, and has a vertical spindle *A*, which carries a fairly broad-faced grinding wheel *B*.

The guide bar *C*, is held vertically on the table, which moves it back and forth past the wheel. The wheel spindle also has a vertical movement, the whole head moving on the column so that the wheel grinds with a wave motion from end to end of the bar. This leaves curved wheel marks in the guide bar which give better results, it is said, that straight grinding. The reason given is that the oil is held in the slight pockets left by the grinding wheel and that the waved lines wear down to a fine bearing surface.

AN ECCENTRIC CHUCK

Eccentrics are bored and turned on the chuck shown in Fig. 3, which is so simple as to need almost no explanation and so substantial as to be worth copying in many places.

The base *A* is bolted to the faceplate of the lathe and in this, the slide *B*, to which the eccentric *C* is fastened. This can be both turned and bored without removing it from the lathe. It is simply necessary to shift the slide *B* from one position to the other and turn or bore as the case may be.

An old English turret lathe is shown in Fig. 4. The turret lies horizontally and carries drills, hook boring tools as at *A*, taps or anything that may be needed for the work in hand. It is also a fox thread chasing lathe, the leader being on the end of the main spindle at *B*, as was customary in the old days.

This is used on brass work exclusively, the turret arrangement somewhat resembling some of the old turret lathes found in gun shops, although the tool arrangement is not the same.

MAKING FERRULES FOR FLUES

In making copper ferrules for locomotives flues, the older method has been abandoned and they are now cutting up the tubes to the right length, holding them on the expanding mandrel shown in Fig. 5 and things are going very smoothly indeed.

This holds any size ferrule and the expansion is secured by turning the expanding screw *C*, which opens the fingers *B* and holds the ferrule *A*, tightly in any position, according to its size. It is then an easy matter to turn it to size, face the ends and finish it ready for the boiler shop.

In the tool room is the old Pittler lathe which is the first I have ever found in a railroad shop. The bed is triangular in shape. The carriage encircles the bed and is turned on the outside. The tool rest fits this and can be moved around on it, so as to bring the tool into any desired position. The tool is also adjustable by a small slide which supports it.

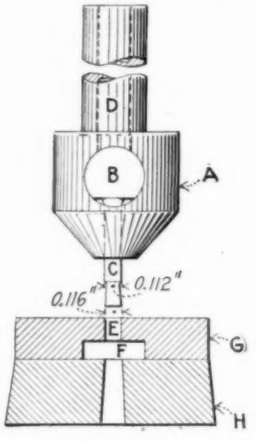
A Nut Die

BY G. H. WILCOX

We have a great deal of small-hole punching to do and the form of punch shown in the figure has proved the best for all holes under ¼ inch. This form of punch requires a guide stripper *G* for the die when the thickness of the metal exceeds the diameter of the punch.

The punch consists of the punch holder *A* in which the punch is keyed in place by the round pin *B*, the underside of which is made taper. The hole *D* is large enough to let the head of the punch through. Punch *C* is a driving fit and is left long enough to a little more than go through the stripper and work. The key end of the punch is headed over and the work end filed taper as shown.

The die, *H* has fastened to it the guide stripper *G*. The opening *E* is made to fit the locating bar *I*, in which the nut fits at *J*. At *K* is the stop pin that stops the bar in the right place.



A NUT DIE

All parts of both punch and die must be tempered with the exception of the punch shank.

The copper used for most classes of work can be what is known commonly as casting copper. This may be either of the electrolytic or Lake grade, if purchased in America, or a high-grade casting copper in other countries. For fine work nothing but high-grade electrolytic copper, Lake copper, or highly refined copper should be used. The zinc used for making a brass alloy should be as pure as possible. If scrap is used in the mixture, it should be melted with the copper and then a sufficient amount of zinc and lead added to bring the composition to that desired. In melting any brass alloy some of the zinc will be oxidized or volatilized, and hence when scrap is used it is always necessary to add some new zinc.

Power from Compressed Air

By H. Macintire

Air transmission in pipe lines. Developing power from an air system. The economy obtained and the possible applications.

In the transmission of compressed air local conditions are the all-important factor, and these conditions will affect the laying out of the pipe line to the same extent as in power-station design in different parts of the country.

The loss of head or pressure has been found to be proportional directly to the density and the length of pipe, as the square of the volume discharged and inversely as the diameter in inches. In other words, the economy of transmission depends, exactly as in the transmission of direct-current electricity, on how much capital is to be tied up in the first cost. For example, in driving the Jeddo mining tunnel a 6-inch main was used to convey air power to two 3¼-inch machine drills over a distance of 10,900 feet and the loss of pressure was only 0.002 pound, a practically negligible loss. However, it would not be economy usually to design a pipe for such low velocity of the air, as the interest and depreciation on the additional investment over the cost of a smaller pipe line would more than counterbalance the saving in fuel.

The pipes, as a rule, are run underground, and are difficult and costly of access. It costs to pass a certain volume of air through a length of 1-inch pipe over three times the head necessary to carry the same volume through the same length of 2-inch pipe, for the periphery increases as the first power and the area as the second power of the diameter. Therefore, as the demand comes on for extra power and an extra pipe is required, the loss of head in the two pipes would be greater than the loss occasioned by a single pipe of an internal area equal to the sum of the areas of the two pipes. The ratio of the periphery to the area of the transmission pipe is the important point affecting friction loss of head.

Other Factors Affecting Loss

Besides the diameter, the factors affecting loss of head are. The condition of the inner surface, the kind of joint employed, the number of valves and bends, and other factors of like nature. Although a number of tests on the mains in Paris and elsewhere have been made, the data obtained have not been full enough to enable any but approximate calculations. The allowable velocity, however, was clearly brought out. In each case with an initial pressure of 100 pounds, it was found that a loss of 2.4 pounds per mile in the pressure occurred with a velocity of 25 feet per second, 9.4 pounds per mile with 50 feet per second, and 46.2 pounds per mile with a velocity of 100 feet per second.

Many of the precautions taken in laying out a steam-pipe line are required for air transmission. The joints must be carefully made so as to prevent air leaks and to eliminate friction as far as is possible; allowance must be made for expansion and contraction, especially if the pipe is carried above ground; pockets in the line without means of emptying the segregated moisture must be avoided, and, finally, provision must be made for repairs on the pipe should these be necessary.

In general it can be said that the air motor, or machine, is one specially designed for the working fluid. The pneumatic tool cannot be easily described because of the great diversity in the varieties of makes. It uses, however, a pump diagram; that is, it takes air for the whole stroke, exhausts at the end of the stroke, and in consequence is not economical.

Moisture in the air has harmful effects during expansion unless some means can be had to prevent the temperature from going below 32 degrees Fahrenheit. During expansion the temperature drops, the expansion being almost exactly adiabatic, to a greater or lesser degree, according to the conditions. With an initial pressure of 75 pounds, and using a pump diagram, the discharge temperature will be —60 degrees Fahrenheit, but when expanding to the back pressure an economical diagram will be obtained and the temperature will be — 144 degrees Fahrenheit. This reduction of temperature is very inconvenient because of the impossibility in practice of removing all the moisture in the air, and of the remainder freezing during exhaust. This fall in temperature can be prevented by injecting steam into the air at admission or by reheating. In the case of the addition of steam, its latent heat is given up during expansion and the temperature of exhaust can be kept above 32 degrees Fahrenheit. However, in many cases steam is not available; if it is available it can be used to drive the motor itself.

The second method—that of reheating—is very practical. A coil of pipe similar to those used for superheating steam is usually placed over a coke or charcoal fire and the air is increased some 300 to 400 degrees in temperature at constant pressure. As, however, dry air is slow in taking up heat from dry walls, water is sometimes sprayed in. The effect is twofold: First, the troublesome fall below the freezing point is avoided, and, second, a great increase in efficiency is obtained. The increase in work is about six times what could be obtained from a first-class steam engine at a minimum first cost. Prof. J. T. Nicholson in experimenting with a 27-horsepower Corliss engine, with air at 53 pounds, found that 850 cubic feet of free air was required per horsepower-hour, and dry reheating to 287 degrees Fahrenheit reduced this to 640 cubic feet, or a gain of 25 per cent. The same test showed that 1.42 pounds of coke per hour were required for each additional horsepower, a result which will compare very favorably with good steam-engine practice.

Economics of Air Transmission

The best idea of air economy can be obtained from the plant in Paris, which has been very carefully tested. These tests have shown the Paris plant to be very economical. The compressor has an efficiency of from 75 to 80 per cent., the transmission line of 95 to 98 per cent., and the motor, of the best design, from 75 to 80 per cent. The poorer designs of motors or those badly worn or adjusted, will show as low as 10 per cent. The Paris plant therefore shows that good economy can be obtained with air as the motive power.

Not only is the economy very high, but the uses to which air power can be put are almost without number. These include all kinds of mining tools, the pneumatic tools used in ship, bridge and boiler construction; pneumatic engines for mining and power-mill traction work, subway and tunnel work where compressed air is used to prevent the ingress of water; for refrigeration to a small extent, and as a means of pumping water (as in the Pohlé air lift).

The advantages of using air are many: It is cheap; there is no danger of explosion from air alone; it is reliable; no insulation is required, nor will the transmission line heat its surroundings.

The great difficulty is lack of flexibility and large first cost. To design an economical plant, either the demand for power must be definite and unvarying or the gift of prophecy must be in evidence. Besides this, the size of the pipe line and the engine is very much larger than electric power would require for the same power, and the difficulty in maintaining the transmission line is greater.

Die for Finishing a Water Pail

By M. Martin

A novel method of finishing an ordinary water pail. Fastening in the bottom and wiring the top in one operation in the press.

The die shown herewith is used in the ordinary open-face press, with sliding table, being fastened in the usual manner to the sliding table.

Fig. 1 shows the general appearance of the bucket with the bottom curled or fastened to the pail body, which is a radical departure from the usual method, that of double seaming. The top of the bucket is shown wired.

Fig. 2 is the general shape of the bucket bottom, made in a combination die, leaving the walls about 7/16 inch deep. It is not trimmed. Attention is called to the peculiar shape of the bottom, which helps to curl the metal and incidentally adapts itself to a very important factor, that of galvanizing, as there are no large gaps or grooves to be filled to finish it.

Fig. 2

Fig. 1

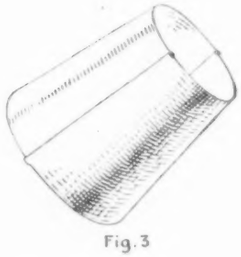


Fig. 3

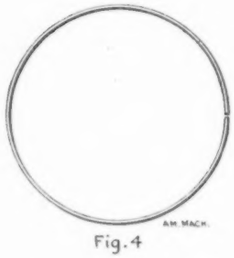


Fig. 4

THE PAIL DETAILS

Fig. 3 is the ordinary pail body, hooked and grooved together in the customary manner.

Fig. 4 is the wire which is cut off and formed in an ordinary bail-forming machine. It is formed slightly smaller than the size required, so that it will hug the groove in the wiring die, and allow the pail body to readily pick it up in the process of wiring.

Fig. 5 is a general view of the die and punch used to accomplish both operations. It will be explained in detail.

Fig. 6 shows the top of the pail wired. A cast-iron bolster A is machined as shown, has the center bored out, as at A_1, which forms the slide for part B. Spring pockets at A_2 support this form. The groove A_3 holds the wiring jaws C in place. A_4 is another groove in which is placed the oscillating ring. There are six T-slots A_5, in which the jaws D slide. The pail form B is machined on the outside to the exact shape of the pail body. It is hollow and made of cast iron. This form slides up or down in A_1, as shown, and is held in position by several shouldered screws (not shown). These are so regulated to allow sufficient travel. Numerous spring pockets exactly opposite those in A_2, contain springs of sufficient strength to support the weight tool-steel wiring jaws C are made to contract, and are held in place by a dowel pin. They are a sliding fit, and have spring pockets in the back to always force them out as far as possible. (Neither the dowel pins nor spring pockets are shown.) These jaws are not hardened. The six sliding jaws D hold the wire in place in the groove of C. They are made of cast iron, machined to fit the T-slot in A_5, after which they are further machined on the inside to form a continuation of the wiring groove in C. A shoulder screw with roller is used to move them. It slides in cam slots in the oscillating ring E, made of machinery steel, and which moves in the groove in the bolster, as described at A_4. The movement of the ring E is imparted by a pin projecting from it through the wall of the groove in the bolster, which is slotted long enough to allow of just ¼-inch movement of the jaws D. (This pin and slot are not shown.) The movements of the pail form B, the wiring jaws C and the wire-holding jaws D are readily seen. Fig. 5 shows the wire in position, the pail body over the pail former B and lightly touching the wire, and the jaws D open, ready to be closed.

Fig. 6 shows the jaws closed and holding the wire down, which is accomplished as explained before by pushing the oscillating ring E by means of the projecting

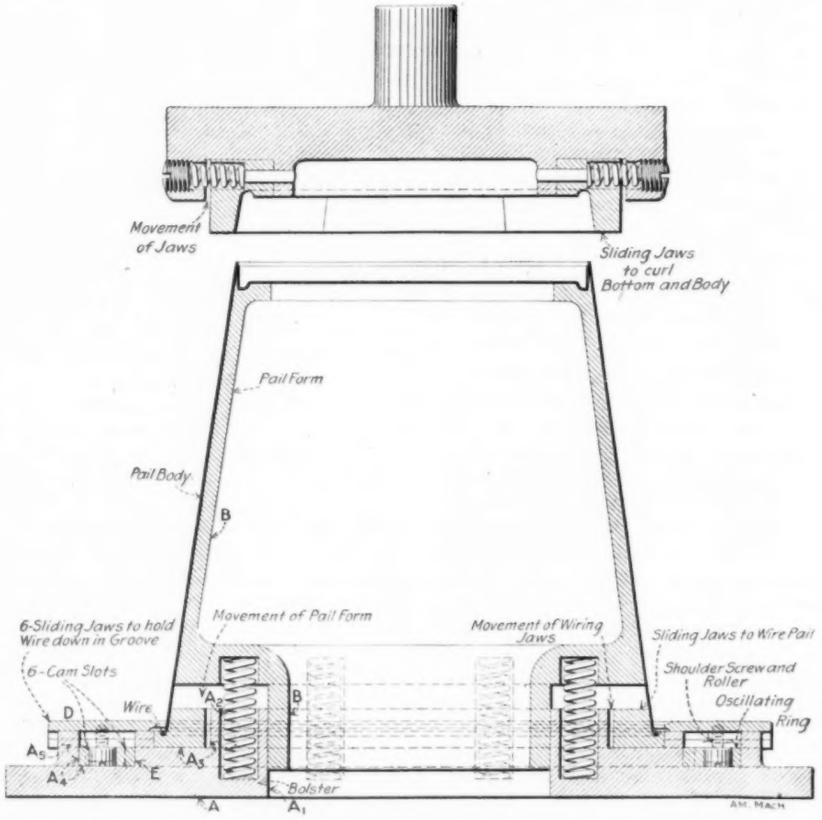


FIG. 5. TOP OF PAIL READY TO WIRE AND BOTTOM READY TO CURL

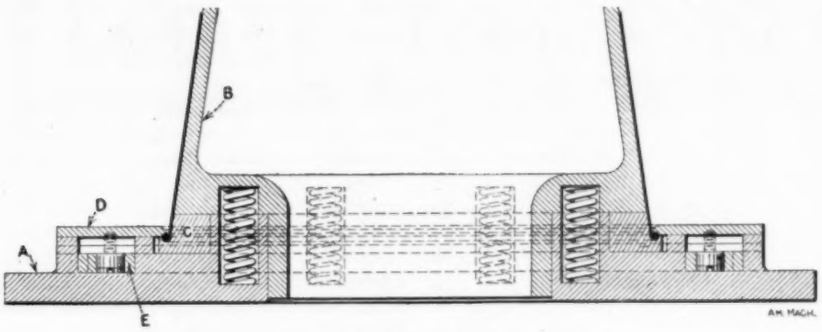


FIG. 6. SHOWING TOP OF PAIL WIRED

pin, which in turn moves the rollers in the cam slot and forces the six jaws *D* forward and over the wire and wiring groove in the jaws *C*.

Fig. 5 also shows the first position of curling or fastening the bottom to the body. Note that the upper part of *B*, or pail form, is machined so that the bottom will fit nicely, and incidentally be centered. After the bottom is placed in position, the pail body is then put over it. The punch shown in Figs. 5 and 7 is made of cast iron and is machined to hold six expanding jaws F_1, Fig. 7, which are made of tool steel and have the curling groove machined in them. They are held in place by a dowel pin, are a sliding fit and contracted by means of springs held in pockets, as shown.

Fig. 7 shows the bottom curled and fastened to the body, and needs no further explanation.

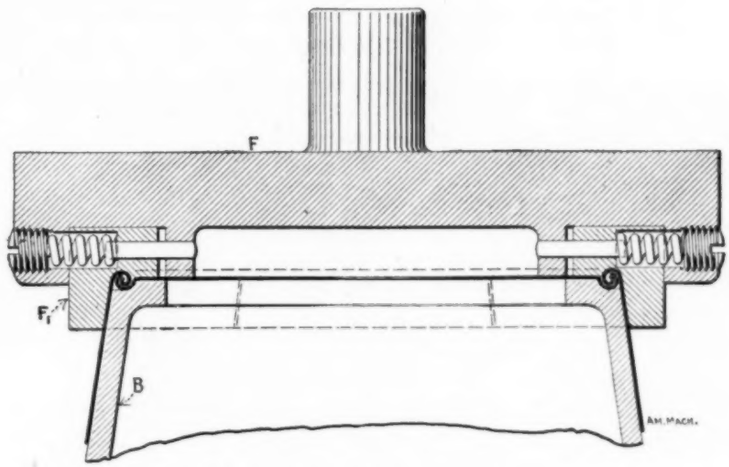


FIG. 7. BOTTOM CURLED TO BODY

Fig. 8 shows the top of the bucket ready to wire, and also shows the change in all the moving parts.

The punch is fastened to the slide of the press by the shank, as shown. The die is fastened to the sliding table of the press, which is pulled out as far as it will go, so that all the parts of the bucket or pail can be put in place. The first step is to place the wire in the groove of the wiring jaws *C*, and then close the jaws *D* to hold it in the groove. The bottom of the bucket is then placed at the top of the pail form *B*, after which the pail body is placed over it. The pail body, which clings to the form *B*, allows just enough of rim to project above the top of *B* to make a perfect curl. The die is then shoved under the punch. The first part of the action, as the punch comes in contact with the projecting pail body and the wall of the pail bottom, is to curl them both around, which is done inwardly, a very easy operation. When this part is finished, the second part of the operation takes place and is caused by the punch, as it strikes the top of *B* in finishing the curl, pushing the form downward, and the open edge of pail body, which has been hugging the wiring jaws *C*, is then forced around the curling groove, picking up the wire and completing this end also. The punch returns, the die is pulled out, and the pail form *B* released by opening the wire-holding jaws *D* by reversing the action of the oscillating ring. The bucket body is removed without any effort. By adopting this method of finishing the pail it is utterly impossible to make a defective pail, as the body holds the bottom in place, and is in turn held and supported by the form *B*. Both operations lend themselves readily to being curled, as the taper of the pail allows an easy inward curl at the bottom, and an easy outward curl at the top. Altogether the action is simple, thorough and very economical.

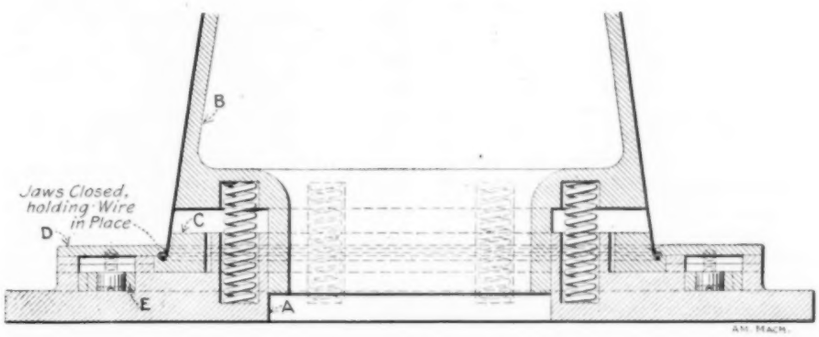
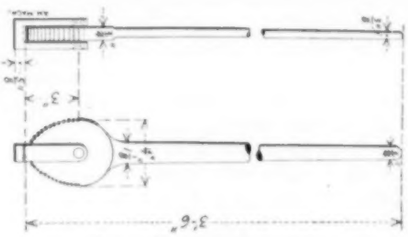


FIG. 8. SHOWING TOP OF PAIL READY TO WIRE

Core Anchor Pulley

BY THOMAS W. HARTLEY

We had trouble in getting core anchors out of heavy castings. The tool shown in the accompanying illustration has eliminated this. The whole piece is made out of tool steel, also the U-shaped dog. We cut the teeth in the latter with a long chisel, according to the dimensions in the sketch. The puller will handle anchors from ⅛ inch to ¾ inch in diameter. It may, of course, be modified to meet the needs of any work.



CORE ANCHOR PULLEY

The use of a little phosphor-tin or phosphor-copper in brass will tend to prevent blow holes in castings by removing oxidation troubles.

Machine Tools Used by Mining Companies

By C. A. Tupper

One secret of successful modern management in the operation of large mining properties consists of keeping the equipment not only uptodate but also in a high state of operating efficiency. Hence, it becomes customary, with the more progressive superintendents, to provide machine and forge-shop appliances, as well as other tools, which are sufficient for all necessary maintenance and repairs.

I observed some very good examples of this tendency during a recent extended tour of the iron and copper ranges of northern Wisconsin, Michigan, Minnesota and Ontario. In fact, two or three of the repair plants noted were unnecessarily elaborate. The best example, probably, of good, hard common sense shown in the selection of equipment for practical service was found in the shop of the Biwabik Mining Company, Biwabik, Minn., on whose property the original discovery of Missabe ore was made.

An Excellent Example of Mine Repair Plant

The origin and development of this repair plant is interesting for what it suggests. Primarily, the use of the steam shovel was responsible for it, the first stripping and loading of ore on the Missabe range by this means having been done here. The earliest machine was a Marion, style "A," of the friction type, built in sections and hauled in from the nearest railroad tracks, then 10 miles away. There followed larger steam shovels, yard locomotives, steel dump cars, the installation of a huge gyratory crusher (recently replaced by the largest in the world), the erection of electric power, compressed air and pumping plants and the maintenance of extensive drilling equipment, for all of which repairs or other work were continually being demanded by the ordinary requirements of service. As any interruption or hampering of operations might mean serious loss, particularly if occurring toward the close of the shipping season, the company's superintendent, J. S. Lutes, early saw the necessity for a good repair plant, which has now been in use for the past decade.

The present equipment includes a Lodge & Shipley engine lathe, Von Wyck speed lathe, Cincinnati planer, Bickford driller, Acme threader and cutter, Quincy hack saw, Buffalo forge and blower, Morgan Engineering Company's hammer, a crane and minor apparatus, such as grinders, punches, riveter and sheet-metal tools. All power machines are driven, as required, by shafts and belting, from a small high-speed Ideal engine. Owing to the intermittent character of the service, it would not pay to install individual motors for operating any of the tools; but, in any future rearrangement of the plant, an electric motor would probably be substituted for the engine. All of the equipment is housed in a substantial building and conveniently arranged.

For mining work in general the care of the drills is an important item, and there should be good facilities provided for the proper heat treatment and shaping of the steel, sharpening, etc.

Where steam locomotives are used, the maintenance equipment must be practically the same as that of a junction roundhouse, with the addition of a fairly large lathe; and this will also take care of most steam-shovel repairs. Gasolene-haulage machines require less; but electric locomotives call for some special tools for the windings, commutators, etc., the same as used by interurban railways. In fact, for deep mining the growing use of motors, both under and above ground, also make additional demands in the same direction, so that a small but quite complete electric-repair department becomes a desirable adjunct to the main shop.

A hand-operated crane of 5 to 10 tons capacity, or even one or two overhead crawls running on I-beams, facilitate very materially the handling of all important work, and in many places a good crane is practically indispensable. Portable chain hoists can also be used to good advantage.

With small autogenous-welding plants many castings can be saved, without ordering more, and these are now being quite extensively introduced.

When ore-reduction mills, smelters and metal refineries are operated, either in connection with mines or independently, the functions of repair plants become much more complex. Some of those started a number of years ago have become so large, as in the cases of the Calumet & Hecla and Anaconda Copper mining companies, that now they not only keep in order but also build the bulk of the ordinary equipment used. This is, to my mind, a doubtful economy; but it serves as an illustration of modern tendencies. One of the objects is to keep in their employ a good force of trained men busy the year around.

Increasing Importance of This Field to Machine-tool Builders

To give an accurate list of the tools ordinarily installed for repair work by mining companies, under the widely varying conditions existing, would require much space as well as many explanatory notes; but any machine-tool builder or sales agent can approximate this very closely for himself by examining the illustrations in a standard set of catalogs of mining, ore-reduction and refining equipment. Viewing these, it will be relatively easy for him to figure out, in his own mind, what classes of tools were used in the manufacture of each and how far something similar be needed for repair work.

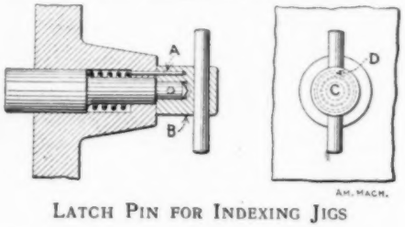
A large and increasing field lies in this direction, and its intelligent cultivation would result to the benefit of all concerned. At present the needs of mining companies are largely supplied with second-hand tools; and those newly organized often have palmed off on them equipment of obsolete, uneconomical types which is dear at any price. Not infrequently, the operation of this is so unsatisfactory that it is used only when emergencies compel; and, so far from extending or improving the plant, the management orders its repairs from a distance as much as possible, even at the expense of delays. On the other hand, with good new or rebuilt tools, the tendency is to put a skilled mechanic in charge of the machine and forge shop and to gradually extend its usefulness, with successive purchases of equipment.

Latch Pin for Indexing Jigs

By R. M. Young

The accompanying cut shows a spring plunger which I have found to be a great time saver when used for indexing jigs of various kinds.

The secret of the usefulness of this plunger is that it is quick and very accurate, and with the single addition of the small pin the jig can be revolved to



Latch Pin for Indexing Jigs

the next index hole without fear of the plunger fouling in any way.

The pin *A* is set into part *B* by drilling a hole and driving the pin in tight, as shown. Then alongside of the plunger hole *C* another hole *D* is drilled an easy fit for pin *A*.

Now it can be readily seen that when the plunger is withdrawn till pin *A* is clear of the hole *D*, given a slight turn in either direction and then let go, the pin will rest on the surface and hold the plunger out while the operator revolves the jig to the next index hole, and a slight turn allows it to drop in again.

In a copper-zinc alloy or what is commonly known as a brass or yellow metal, all the constituents are soft and the alloy is more or less malleable until more than 35 per cent. of zinc is present; beyond this point a hard constituent or compound appears in the alloy, so that it is no longer suitable for bearing purposes.

Letters from Practical Men

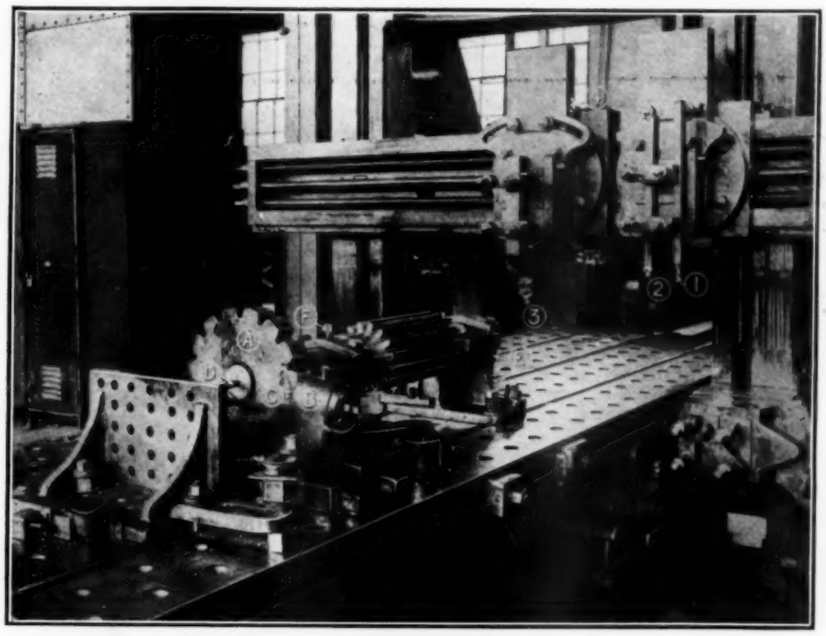
Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Fixture for Cutting Pinions on a Planer

In building two large vertical multiple-spindle tapping machines we had occasion to cut eight 15-tooth, 2 diametral pitch pinions, with three feet two inches face, which were forged from 70 to 80 carbon open-hearth steel. The capacity of our gear cutters and millers not being sufficient to handle this length of face, it was necessary to devise a rigging for cutting them on a planer.

As the pinion and spindle were forged in one piece it was practicable to mount in double bearings as shown in cut attached marked *E*. The index plate *A* was made twice the diameter of pinion and had 15 tooth spaces cut in its periphery. This we keyed on the end of the shaft. The holder *B* was set at the required hight and at an angle of 12 degrees with the horizontal, or one-half the pitch angle. This enabled us to set the cutting tools directly over the center of the shaft. The index pin *C* was made to fit the tooth space and was held in position with the setscrew *G*. The setscrew *D* was set up against the end of the shaft to take the cutting thrust. The shaft was held rigidly in the bearings by clamps and the setscrew *F*. Two roughing tools 1 and 2 were used to remove most of the stock. The finishing tool 3 was made from flat stock and was backed off similar to a gear-tooth cutter; this enabled us to sharpen by grinding off the face. This tool was bolted to the holder by three body-bound bolts, and was squared up by the shoulder on the tool holder.



A Fixture for Cutting Pinions on a Planer

When we first considered this operation we estimated the time required to mill the teeth to be 38 hours. We derived this result by assuming a milling feed of one-half inch per minute for both roughing and finishing cutter, which is very conservative for the high-carbon material to be milled. The actual inches to be cut on one pinion is 570 inches; this multiplied by two gives 1140 inches, or the distance traveled, in completing the tooth space in two cuts; and with a feed of ½ inch per minute this gives cutting time of 2280 minutes or 38 hours, which does not include the setting up or indexing.

As the actual planing time, including setting up, for one pinion was eighteen hours, we saved over 53 per cent. in the cost of cutting the teeth by planing as compared with milling.

McKeesport, Penn. T. A. Dare.

An Edge Forming Die

The automobile headlights used on the E. M. F. and Ford cars embody in their construction a peculiarly shaped ventilator, or "head," as it is commonly called, the form of which demands several extraordinary press operations. Among these may be mentioned the forming of the side strips containing the rivet holes by which the part is attached to the lamp body.

The hood is shown in detail in Fig. 1, where *A* represents the part before the sides are formed and *B* the same piece after forming.

The die used for the accomplishment of this is shown in Fig. 2. The base or shoe

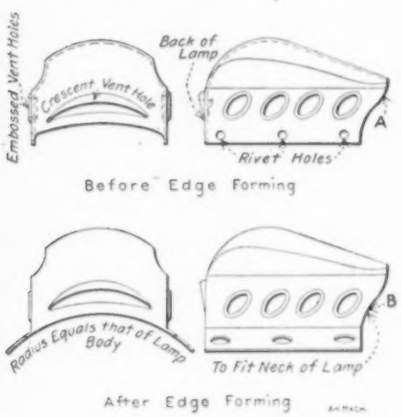


Fig. 1. Top of Ventilator of Automobile Lamp

A is of cast iron with a suitable flange at its lower portion for attachment to the bolster plate of the press. The upper surface of *A* is machined with a groove for the reception of the tongue on the hardened tool-steel forming block *F*. This block is attached to *A* with heavy screws and dowel pins. The latter, of course, merely preventing lateral movement of the block on the base, as the heavy strains are taken care of by the tongue and groove. A soft-steel guide plate *B* is screwed and doweled to the left-hand vertical surface of the base. The upper portion of this plate acts as a retainer for the pressure bar *C*, which slides in the channel formed between the plate *B* and the casting *A*. This bar is pressed upward by two stiff helical springs, which are pocketed in its lower surface, and its

vertical movement is limited by two shouldered screws *E*, the heads of which slide in counterbores in the upper surface of the bar.

A shallow channel extends the entire length of the upper surface of the bar to accommodate the inner projections of the embossed openings in the sides of the ventilator hood. The upper portion of the tool comprises a cast-iron punch holder

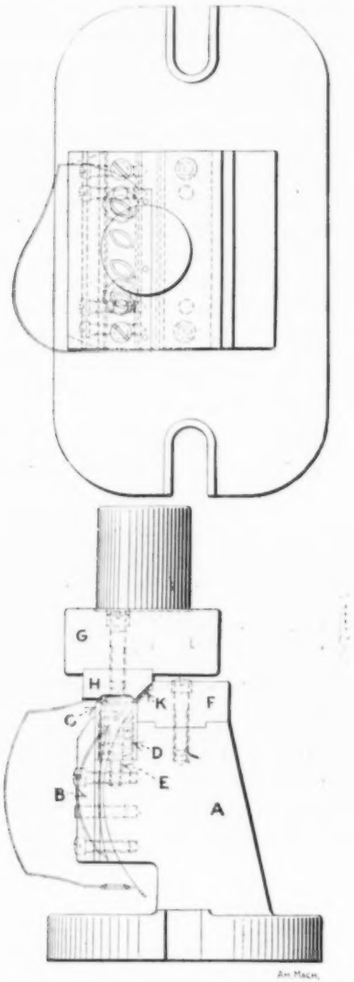


FIG. 2. PRESS TOOL FORMING SIDE STRIPS

and stem *G*, on the lower surface of which is attached, by means of screws and dowels, the hardened tool-steel forming punch *H*, as shown in the illustration. The lower surface of this block is channeled in a similar manner to the upper surface of *C*, for the accommodation of the embossing around the side holes.

OPERATION OF THE TOOL

The operation of the tool is as follows: When the punch holder is up the pressure bar *C* is forced upward by its springs to a point on a line with the offset ledge *K* on the block *F*. The hood is placed over the die until its edge butts against the gage surface of *F* at *K*. The casting *A* is undercut, as shown in the illustration, for the proper clearance of the lower edge of the hood. As the punch holder *G* descends the side of the hood is firmly gripped between the pressure bar *C* and the forming punch *H*, both of which then travel downward, permitting the block *H* to form the side over the die block *F*.

The die is made to permit of forming both hood edges, and in consequence the left-hand front and back vertical edges of *B* are beveled off, so as not to interfere with the crescent-shaped lip, which extends inward from the end of the hood, as shown in Fig. 1. This die is very fast in operation, and while comparatively inexpensive to build, produces excellent results, the accuracy of forming being such that the rivet holes in the edge line up accurately with those in the lamp body.

Detroit, Mich. ARON LAWRENCE.

Plugs for Punch Press Flywheels

The hardened-steel plugs for the flywheels of the punch presses built by the Waterbury-Farrel Foundry are first turned, drilled and tapped on one end and then cut off, this operation being done in the turret lathe. The pieces which are plain cylindrical plugs as shown at *A*, Fig. 1, are then put in the jig shown also in Fig. 1. The member *D* is in one piece with the body of the jig. The parts *E* and *F* are separate and are merely clamps which are closed on the plugs by the through bolts *G*. In this jig the flats are milled on the plugs, making them as shown at *B* and *C*.

The plugs are then hardened and tempered, after which they go to the cylindrical grinder and are ground to size on the outside.

The method of holding is very simple, and is shown in Fig. 2. As previously stated one end of the plug *A* is tapped. This is screwed on to the threaded end of the arbor *H*, Fig. 2, as shown, and ground a forcing fit for the hole in the flywheel. These plugs never come loose and seldom break, but when they do, as they are ground to gage, a new one can be sent to the customer with the assurance that it will fit.

New York. J. M. BAIN.

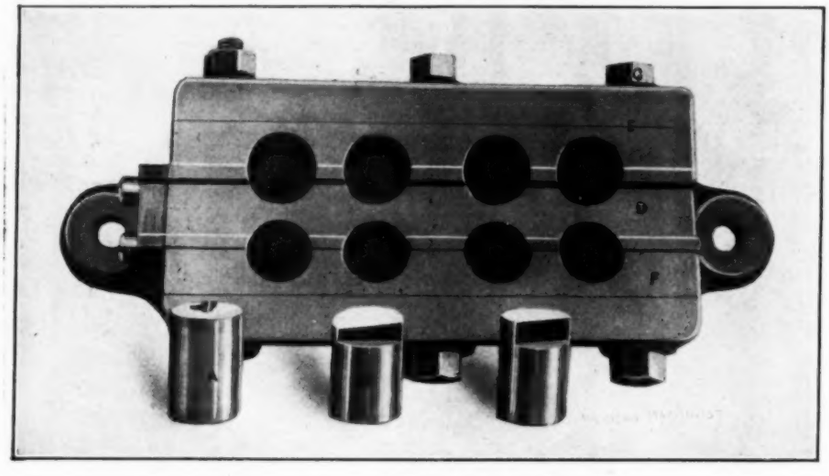


FIG. 1. THE PLUGS AND THE JIG

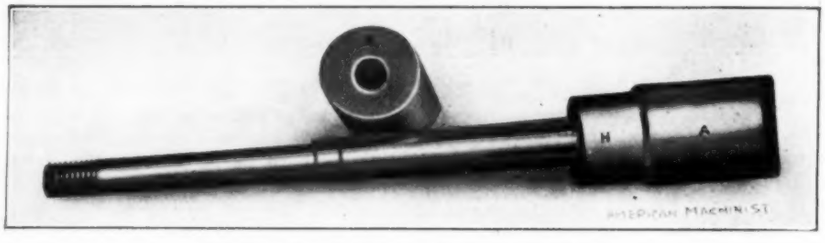


FIG. 2. THE GRINDER MANDREL AND PLUGS

The classic work of Doctor Dudley as the head of the laboratories of the Pennsylvania has gone far to standardize railroad practice throughout the country. Few even among railroad men realize how greatly the whole community is in his debt. His specifications cover rails, soaps, disinfectants, oils for signals and for lubricating, paints, steel in special forms for every use, car wheels, cement, signal cord and every detail of equipment. He has made the transportation of life and property cheaper, safer and more expeditious by reason of his application of chemistry to the problems of railroad management.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

To Turn a Spoke Round at One End and Oval at the Other

I put the spoke between the head center (from which end it is driven by a dog) and a movable center in the tailstock.

The motion of the tail center is obtained by the following mechanism: The piece *M* fitting the tail spindle has two cylindrical parts *P* and *J*, of different diameters. The larger one *P* is eccentric while the smaller one *J* is concentric with the taper body of *M*. A bushing *B* has an eccentric hole in which *P* fits. The eccentricity of the hole is the same as the eccentricity of *P*. This enables us to bring the bushing *B* from concentric to any desired eccentricity with relation to the journal *J*. The greatest eccentricity will be twice *E*. When the correct eccentricity is obtained, which is half the difference between the two axes of the oval, in this case $1\frac{7}{16}$ inch minus $1\frac{3}{16}$ inch $\div 2 = \frac{1}{8}$ inch, the bushing is securely fastened by means of a setscrew. The smallest part of the bushing *B* carries a sliding block *D* fitted into the groove *G* of the disk *A*, which has on its other side another groove *G'* at right angles with *G*; both grooves are of same depth, i.e., half thickness of the disk. Thus *A* will have a rectangular hole in its center where the journal *J* passes through. *J* is also provided with a sliding block *D'* fitted in its groove *G'*. Another disk *F* is secured to the disk *A* and concentric with it. This disk carries a center which has a spring washer *W* to continually keep a pressure on the spoke as it traversed to and fro across the true center. The disk *F* has a driving slot *I* in the same direction as the groove *G'*. This is used to drive the disks *A* and *F* together by means of a dog fixed on the spoke.

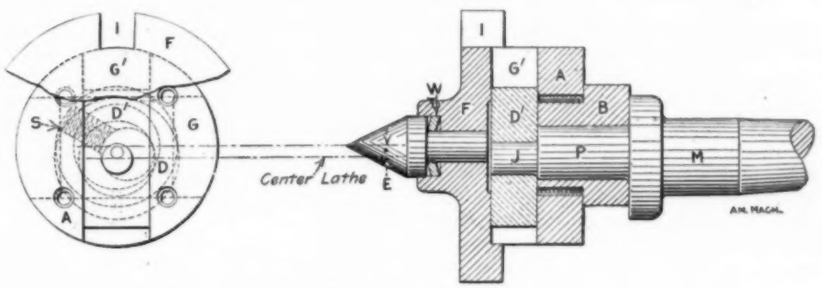


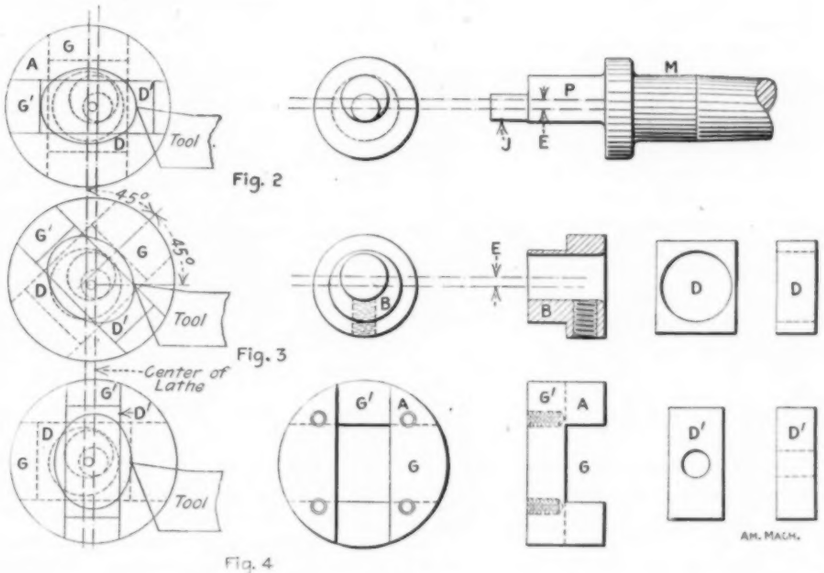
FIG. 1. THE TAIL CENTER

Fig. 1 shows an assembly of the mechanism. Fig. 2 shows the position where the spoke is at its greatest eccentricity owing to the perpendicular position of the groove *G*. Fig. 3 shows the spoke half way between its major and minor axes. Fig. 4 shows it with the tool at the minor axis. In this position the groove *G'* is perpendicular and the spoke is concentric with the lathe. Each of these positions occurs twice for every revolution of the work.

The other end of spoke remains round because its center does not change its position.

CHARLES DE GREVES.

Antwerp, Belgium.



THE PARTS AND THE ACTION OF THE DEVICE

An Assembling Fixture for a Type-bar and Pivot

On page 682, D. A. Charles shows an assembling fixture for a typebar and pivot, the working of which is not quite clear.

A pivot is first dropped into the hole in the pad and rests on the punch *L*, the bar is laid on the table *J*, the ram moves down and thus the bar and pivot are assembled.

So far so good, but he goes on to say that the assembled part is then removed and the pin *O*, releasing the spring *P*, removes the pressure of the pin *R* and allows another pivot to drop down into the hole ready for the next bar. This part is not clear at all, since the pin *O* releases the spring *P* when the hole already has a pivot in it and the typebar is in place, and when the fixture is open to allow the removal of the assembled piece the pin *O* is nowhere near the spring *P*. Even if it were, such a condition would be useless as there is no provision to prevent more than one pivot dropping out of the magazine.

If it is intended to bring the punch and die together after removing the assembled typebar for the sole purpose of dropping a pivot into the hole ready for the next

bar, the design is a poor one, for the operator could drop each pivot into the hole just as quickly by hand.

It seems absurd to have the operator stand up every minute or so to load the magazine and then have to go through a double movement to assemble the parts.

Chicago, Ill. HAROLD LAMB.

Ink Reservoir for Lettering Pen

The accompanying drawing of an ink reservoir for lettering pens, which I have used for three years is, I believe, much better than the one shown on page 702. This device is made of sheet brass,

about ¼ inch wide. The only labor in making it is to cut the brass to the required length, round one end slightly where it engages the pen, and then bend.

It has the following advantages over the one shown on page 702: Slight labor to make, does not impede spreading of the nibs in making a shaded letter like the nibs in making a shaded letter and, most important, it is easily cleaned without removing from the holder.

It is inserted in the pen holder opposite the pen in the same way that the pen is held.

Swampscott, Mass. R. F. HATCH.

The Foreman's Office

A short time ago an interesting contribution appeared in your columns on "Shop Furniture" (page 1015, Volume 34), the writer of which after describing a useful foreman's desk makes the sweeping statement, "The foreman in a modern shop is no office clerk or scribe," and a little further on adds, "He ought not to sit in a closet."

These statements I think should be interesting to a large number of your readers who are foremen, and find an office most useful to them.

I have held the positions of foreman in England, Scotland and Ireland, and know British shops fairly well. Some I know boast that they have no foreman's offices and it would be equally true to assert they have no foremen either, the usual method being to place each department in charge of a manager with a suitable office. His assistants are termed foremen with writing desks in suitable positions. This system may be commendable in many ways, but is no argument against an office for the foreman who in many shops occupies a position similar to the aforementioned manager.

The foreman who can take charge successfully in the modern shop must be able to do personally, or supervise (a clerk being necessary in some cases) a good deal of clerical work, and a foreman who is negligent will upset the finest system ever invented.

The good foreman will to a great extent be in the confidence of his works manager or directors, and will consequently be often consulted on matters not intended for the whole shop. Telephones, card systems, and many other items that are necessities for the machine foremen do not look well hanging around a desk open to all the dirt of the shop. A word of advice or a reprimand may be given to a man or boy with better results out of range of the ears of the shop. An office in the shop is not a costly affair. It can be arranged to overlook the whole department in most cases.

To be a successful foreman in a modern shop, it is necessary to be able to look at things from the viewpoint of the employer, as well as from the viewpoint of the employee, a most difficult position considering the antagonism of capital and labor. The latter view is usually the first in possession as the foreman has worked up through the ranks and the viewpoint of the employer has to be obtained gradually; the directors who assist in the reaching of this point will get value for their money, while the workman will also benefit. Some writers even recommend that foremen should be given a share or interest in the business, but there are many other ways of making the foreman interested.

Many British firms do a great deal more than this to make the foreman's life more pleasant, realizing that the best foreman, while able to command the respect of the workman, is ostracized as far as the social side of their life is concerned.

A few years ago, the week following the fall of Port Arthur, a social gathering of some 250 Clyde foremen was held in Glasgow. These men covered the whole ground from explosives to machine guns, from sewing machines to dreadnoughts, from the delicate compass to the largest marine engines yet constructed. One of Glasgow's most prominent citizens in proposing the health of these men made some very plain statements to the employers, a number of which had gathered there, concluding with the remark: "I could obtain a king's ransom for these men tonight," a statement that could have been made of similar foremen wherever this journal is read.

But are we also to understand that none of us is worth a small office in which to hang one's coat when on duty in the shop?

Belfast, Ireland. F. P. TERRY.

Centrifugal Effects on Belts

I have noticed that writers in your columns and elsewhere, almost universally assume the centrifugal effect on a rope or belt to be exactly according to the peripheral velocity of the pulley. J. T. Towlson's article on page 484 is a case in point.

This is ignoring the law, "The centrifugal force varies as the square of the revolutions per minute and exactly as the diameter." According to this law the centrifugal effect on a belt running around a 4-foot pulley at 250 revolutions per minute is only a quarter of that on a 1-foot pulley running at 1000 revolutions per minute, although the peripheral velocity is the same in both cases, viz., 3142 feet per minute. To carry the matter to extremes, the centrifugal effect on a belt running around a pulley the size of the earth at a speed of 200 million feet per minute, would be the same as if it were running 6280 feet per minute on a 4-foot pulley.

Centrifugal force is due to the fact that each particle in a revolving body is trying to move in a straight path, while being constrained to follow around a curve. This being so, it follows that the sharper the curve the more each particle is being forced from a straight path in a given distance traveled and the greater is the centrifugal force, though at the same time the peripheral velocity may be constant.

Thus by keeping the pulley large, the greater is the velocity the belt or rope can be run at without loss of efficiency.

Of course, the smaller pulley of a pair would be the limiting one. Perhaps this explains the examples quoted by Mr. Towlson, as the wheels he referred to were large in diameter.

P. B. ASHWORTH.

Gloucester, England.

The excessive shrinkage of brass or bronze alloys makes it necessary to have a core which will be crushed readily by the molten metal. Large cores should be made with a soft interior, and this is generally accomplished by filling the interior of the core with cinders, powdered coke, or some other similar material. It has already been stated that the core material must also be fine, and this necessitates the use of finer sands for brass-foundry cores than those commonly employed in iron-foundry work. When a brass casting has been poured and is shaken from the mold, care should be taken to keep the core sand out of the molding sand as far as possible. The cores for brass and bronze castings are sometimes blown out by shaking out the molds while the castings are still fairly hot, and then dipping the castings into water. The steam generated in the cores blows out the core sand. This also gives the castings a better color. Iron castings subjected to this treatment would be broken, but brass castings are rendered softer.

A Plan of Shop Medical Service*

By W. Irving Clark†

Results of a brief experience with a plan of a regularly organized shop medical service.

A shop hospital and dispensary, with the foremen as first-aid doctors, and a graduate physician in charge.

*Extract of a paper read before the annual convention of the National Machine Tool Builders Association.

†Medical doctor in charge of medical service of the Norton Company, Worcester, Mass.

Those things which I am going to say are really the results of an experiment. When we started this work we did not know how it was going to come out, and for that reason we have rather held back from saying anything about it. However, we feel now that we have gotten enough data together to be able to look a little further into the future, and to give you an idea as to how far the matter presents itself to us. The Norton Company had no medical department until about four months ago, so that this thing is the growth of four months.

Now when you start establishing a medical department it is really more of a job than it might seem at first glance and therefore the work is rather necessarily slow. Many companies have a doctor who looks out for accidents to their men; but we do a great deal more than that. Our medical department is divided into three functions; first, the care of accidents; second, physical examination of every employee; third, a dispensary function. I am going to elaborate these a little more carefully.

Care of Accidents

The question of the care of accidents is met in all factories. There is no factory that does not have some provision for the care of accidents. It may be simply first-aid talks, usually very incompletely covering the subject; or it may be a series of hospitals such as you will find in the American Steel and Wire and some other of the large manufacturing corporations; but almost every factory has some way of handling this problem.

Now while I give you the way in which we are handling the problem, I do not pretend that it is the best way, but I simply am showing a way of handling it in connection with other things that this medical department is doing.

In the first place, say a man is injured in the shop or wherever else he is working, the usual thing in these cases is for everybody to drop their work and run to the man who is injured, nobody knowing exactly what to do. One man runs off for the first-aid set; another man fans the injured one, etc. The time lost is considerable, so that our first idea was to try and get one man who would be responsible in each department for the attention being given the injured individual. In our case we have very efficient foremen, and we have arranged that the foremen shall take charge of an accident case as soon as an accident occurs.

Instructions to Foremen

Now how is the foreman to take care of it? The foreman does not know any more about medicine than the majority of men. He is absolutely ignorant about it except in a really elementary manner. He still adheres to the old idea of putting tobacco on a wound to sterilize it. We have assembled all our foremen together and they have been lectured just exactly like a class of medical students on the subject of first aid. These lectures have been given once a week, lasting only 30 minutes. The lectures are made as simple as possible. They are illustrated by blackboard drawings and by the doctor actually applying the bandages. An effort is made in every way to interest the men. That the men have been interested is proved by the fact that they have taken right hold of it. It has been further evidenced by the examinations of foremen after a course of lectures had been delivered. They are examined orally, and almost all are asked to come up and put on bandages. This is done once a month right straight along, because otherwise they will forget.

In addition to that, we are taking the foremen of every department on various days of the week and having them come to the hospital and there put on bandages and splints, and get familiar with the proper, clean and aseptic way of doing things.

The Usual Procedure

When a man is injured the foreman steps up and takes care of him. You may ask what he has got to take care of him with? He has these "First Aid" jars. We have used glass jars because they are transparent and we can see that they are full. A glance will tell one that the jar has a certain number of things in it which it ought to have. On the outside of each jar are directions, in case the foreman gets a little excited and forgets what to do. These directions are for the simple applications which he has to make in pretty nearly every case.

After the foreman has attended to an injured man, the next thing that he does is to convey that man either by stretcher or by wagon, depending on the nature of the accident, to the hospital. In the meantime the dresser has been notified. The dresser is a specially trained man who has been given more detailed instructions than the foreman by the doctor in the cleaning up of wounds following upon first aid. The dresser meets the man in the hospital and cleans him up. In the meanwhile a call has been sent out for the doctor, who is somewhere in the city and may always be reached on the telephone, and with an automobile is able to get there within fifteen or twenty minutes, as has been demonstrated by actual experience again and again. It takes just about that length of time from the occurrence of the accident to get the man properly cleaned up and into the hospital. So we have that series of arrangements for any case which comes up. The doctor, of course, can make whatever disposition of the case that he finds necessary.

The Shop Hospital

Now the question probably arises in your minds, what is this hospital? The hospital is the simplest thing in the world, merely in our case a very small room which has been made into a little dispensary. It contains a medicine cabinet, an examining table, a sink with running hot and cold water and a sterilizing apparatus. The total expense of putting this hospital together was under two hundred dollars.

Examination of Employees

Now we come to the second part of our work, which is the examination of employees. This is absolutely new, so far as I know, although it may be done somewhere else.

We examine every employee from the top of his head to the soles of his feet. We have examined some five hundred of the employees.

At first you may not see the reason for putting a man through such a careful examination; but there is good reason for it, for every man has certain defects, and these defects have a definite effect on his work. If, for example, a man has flat feet he gets pretty tired toward the end of the day, and you have got to do something to relieve him if you want his work to stay right up to the top notch. You put that man in proper plates, or have his shoes arranged so as to remedy the flat feet that he has, and he will be com-

pletely and absolutely relieved. A great many of the cases of so called rheumatism which occur in every factory are not rheumatism at all, but due to flat feet.

You will find the same thing in the case of varicose veins; a great deal of difference will be made in the man's comfort in a few days if his veins are properly supported by bandages.

Take a man with rupture who is doing heavy lifting, there is a gradually increasing strain on that rupture, and he is having pain as a result. Put that man in a truss and his discomfort immediately leaves him.

And so I might go on enumerating one thing after another. We pay particular attention to the eyes. The man's eyes are tested separately for near and long vision and also together, of course. We simply test to see whether the man needs glasses; we do not pretend to be oculists. If we find that the man is in need of glasses he is told to go and get them. If he demurs he is talked to a little, and he usually sees the reasonableness of so doing. The correction of this trouble makes a great deal of difference in that man's work.

There is nothing more important than the teeth. We find men who are having toothache all the time. A man with a bad toothache cannot do good work. The teeth should have proper care from the beginning. We are trying to get at the younger men and get them interested in their teeth, and expect to prevent a good many toothaches in that way.

Then we go on to the heart and lungs. We have a great many men in the factory with bad hearts that have been perfectly compensated and apparently give them no trouble. Such a man often does not know that he has a bad heart, but it is discovered that the heart is enlarged. If that man does very hard work in a very hot room, some day or other he may fall into a machine and get pretty badly hurt. It makes a lot of difference to that man if we can get him straightened up. We could do it by changing his work to something which is not going to strain the heart.

And so I could go on enumerating the various things that a man can have or that we have found that they do have. The question has been asked me, how many men are normal? For working purposes all our men have been normal that have been examined. The examination of five hundred men only disclosed two cases of pulmonary tuberculosis, and in one of these cases the man was simply an applicant for work. There was one case where a man was able to work but who had a chronic nervous condition. He was able to work at the light work that he was doing, but I understand that he has since stopped his work. I would say that out of five hundred men examined only one man was found physically unfitted to do his work, but there was a tremendous number of men in such condition that they might become physically unfitted to do their work at any time, or varying lengths of time.

The Shop Dispensary

That brings us through the examination of the employees and how we meet that question, and we now come to the third thing, which is the dispensary. I ought to stop and speak of that in passing. Say that a man feels sick, he has some little inconvenience that he would not go to the doctor for, but he goes to the hospital doctor because he is there, and he has his little troubles straightened out. It may be simply a stomachache, or a number of other things. Before we had this system in operation, sometimes a man would go to the foreman and say that he wanted to go home because he felt sick; and the foreman had to let him go home, there was nothing else to do; but now the foreman sends the man to the hospital doctor, and there the doctor finds that he has a little stomachache perhaps, and he gives him some Jamaica ginger and orders him to take caster oil at night, and the man will feel so much better.

Our examinations are always very carefully made; we are always on the lookout for incipient appendicitis or gall stones, and make very careful examinations. Of course complete records are kept of all these cases and the data preserved on the original examination card, so that at any time we can turn to the card of any man in the factory, see just what his physical condition is, and just what illness or accidents he has had.

With reference to accidents I believe I omitted to say that all our dressings are done in our hospital at the factory, in that way saving quite a good deal of time for the man in his work. If he had to go to an outside hospital or physician for a number of these small dressings it would lose a good deal of time for him.

Forms and Literature

Our literature consists of examination cards, first-aid directions, slips that we send out and have the foremen sign. so that we are able to check up the men and find out why they are out, how long they are out, and whether they are malingering. When a man is sent home by the doctor he has to report at the hospital to the doctor when he comes back. We want to know whether his sickness was the real thing, or whether he has been loafing. Then we have instructions to dressers. We try to keep the dressers uptodate, not only with lectures but by keeping them well posted with printed instructions from time to time. First-aid directions are posted up in every department, as well as being distributed to the foremen.

Flameless or Surface Combustion

By I. W. Chubb

For two years Messrs. McCourt and W. A. Bone, of Leeds University, England, have been developing the discovery by Sir Humphry Davy of flameless combustion. Davy, it will be remembered, some time before 1818 devised a flameless lamp on the knowledge that platinum would induce combustion of inflammable gases. A well known gas igniter is based on the ability of spongy platinum to cause hydrogenous gases and oxygen to unite. Lately porous firebrick substances have been shown to support surface combustion, and the investigations made by the Leeds professor and his colleague have led to the discovery of special material as porous solids. By means of crucibles surrounded with this material, broken in pieces, cast iron has been melted in 10 minutes, and it is stated that carborundum has been split into its constituents of carbon dioxide and silica. Practically perfect combustion is claimed, but it is necessary to insure the correct proportion of air in the gas mixture.

A special mixing chamber has been devised and the gas and air are supplied under pressure, so that, in fact, the speed is greater than that of the explosion wave through the mixture. The result is flameless combustion, the surface of the special material being raised to an exceedingly high temperature, as shown by the decomposition of carborundum. A small boiler, having 10 tubes 3 feet in length, has burnt 1000 cubic feet of gas in an hour, the evaporative duty being stated at 20 pounds of steam per hour per square foot of heating surface. The steam pressure was 100 pounds gage. Allowing for the power taken by the compressor for supplying the gas mixture, the net efficiency was 90.3 per cent. At the boiler front the gas is forced through ¾-inch holes in fire-clay plugs, and the packing of the special refractory material is placed in the front part of the boiler tubes. The chief difficulties mentioned are the dangers of back firing, the gas mixture necessarily being of an explosive character, and the high temperatures evolved. The system is applicable to all combustible gases.

Molten metal which is composed largely of copper can be cleaned by poling, that is, by stirring it with a green wooden pole. If pure copper is being treated in this way, it should be stirred until a sample taken and poured into a small button freezes with a level surface, showing neither depression nor swelling. If the stirring is continued too long, the metal will be injured by the absorption of gases.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1910, 1,488,400 *copies. For October,* 1911 *(American weekly, American monthly, English weekly and German weekly) total,* 94,750.

Of this issue 22,000.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 133

American Machinist

Forward Movement of Mechanical Engineers

When the United Societies Engineering building, in New York City, was dedicated, President Hadley, of Yale University, emphasized the fact that engineers as a class were not occupying the place in public affairs that was their just due. He pointed out that the financiers, journalists and politicians were the masters and leaders of men.

Since that time several movements in the American Society of Mechanical Engineers have had for their purpose the stimulating of interest in public affairs among its membership, and providing means of making the Society's influence felt in regard to public questions. Another movement for service has just been started. The committee on meetings has submitted to the membership, with the hearty approval of the council, a plan to form a large number of subcommittees, each to deal with some particular technical branch of the great engineering field touched by the activities of the Society. The original circular lists 38 such sub-committees and requests suggestions for more. Of these four have already been appointed; namely, on textiles, on cement, on machine shops, and on administration of industrial establishment.

To show the breadth of the plan membership on the committee is not restricted to members of the society. On the contrary, it is desired to include in each committee leading men who are recognized as possessing special, technical knowledge and experience in the particular work that the committee is to consider. The number of members is not limited, although 10 will probably be the usual number of appointees.

These committees are expected to investigate the peculiar problems and needs of the technical branch under their charge, and as may be advisable render reports or suggest means to the general committee on meetings whereby unsolved problems may be brought before the society as a whole, or new developments brought to its attention; with the purpose of keeping the members fully informed as to the best of recent technical developments, and permit of applying solutions of problems in one field to similar problems in other fields.

Behind all of this is the desire to increase the usefulness of the society by extending its activities. It is no empty dream to hope that ultimately its influence may be as great in municipal, state and national affairs as is that of the great Verein Deutscher Ingenieure in the affairs of the German empire.

The plan seems worthy of hearty support, for it promises results of great value. The activities and fields of the American Society of Mechanical Engineers are wider than those of any other American, national, engineering society. When these subcommittees are extended to cover the entire field of professional practice, including all those public and individual interests created by or associated with mechanical engineering, the society as a whole will be in touch with all of the great public questions that have a technical aspect. We congratulate the committee on meetings in having inaugurated this foreward movement.

Reducing Danger in Railroad Wrecks

The efficiency of the steel car as a saver of life in railroad wrecks was again demonstrated recently on the Pennsylvania railroad. An express, consisting of six all-steel cars, was wrecked by the all too common cause of taking a crossover at high speed. The locomotive and three cars were overturned, the road bed torn up and the passengers thrown around the car as might be expected. But there was no telescoping of cars, no splintering of woodwork, and no catching fire of the débris to add further horror to the already shaken nerves of the passengers.

The engineer and fireman were killed, adding to the toll of lives we pay for high speed, but the fact that no passengers were killed should add greatly to our confidence in the steel car.

We must not, however, fail to realize that all steel cars are not equally safe. Some are being built with practically a steel plating or armor on the outside of a wooden car. While this may stiffen them to some extent and prevent fire from outside sources, it does not reduce the danger of fire to any appreciable extent and cannot be commended. Nor should accidents and fatalities in such cars be charged against the steel construction.

While the first cost of steel cars is more than with the older wooden cars, and there may be a doubt in some quarters as to the actual cost of maintenance, the saving in damage suits should make them a paying investment.

The railroads are evidently recognizing this as statistics show that 63 per cent. of the 3783 passenger cars built last year were of what is known as "all-steel" construction, and 14 per cent. of the remainder had steel underframes, which safeguard telescoping, but, of course, do not remove the danger of fire.

The railroads are to be commended for their growing percentage of safe cars, which will not only save life, but also prove economical in preventing damage suits and in repair work.

Machine Tools in Out-of-the-Way Places

It is often profitable as well as pleasant to pry into out-of-the-way corners. In the application of this general statement machine-tool builders and salesmen are no exception. In this issue a correspondent points out the large and increasing field for the sale of machine tools in the repair shops of mining companies.

The growing use and variety of mining machinery, including the application of direct-connected electric motors, has in like degree increased the variety of the repairs and replacements to keep everything in running order. This necessity, as well as the distance from large repair shops and the sections where mining machinery is produced, has brought about the development of extensive re-

pair shops as part of the plant of many mining companies. In a few instances these shops have grown so large that they now not only keep the machinery in order, but also build the greater part of the ordinary equipment.

This field is already large and is rapidly and steadily increasing. It is even now of sufficient extent to warrant intelligent cultivation. At the present time the mining companies buy largely second-hand machines. Under the existing conditions it is not surprising if obsolete, uneconomical types are sometimes purchased. But with proper cultivation there is no reason why modern, high-grade tools should not be bought.

Another field worth considering is large construction work. Today many contractors doing such work install a small machine shop as part of their regular equipment. The location of any one such shop is, of course, temporary, depending upon the number of months or years required to complete the construction work in hand. To show that this field should not be despised, however, we know of one successful second-hand machine-tool dealer who draws by far the greater part of his trade from contractors, and for the purpose indicated above. Owing to the needs of the service, it is probable that second-hand machines will always be used in these shops. Yet their sale adds a certain amount to the volume of machine-tool business, and still further supports our opening statement that oftentimes it is profitable to investigate out-of-the-way corners.

The Cost of Not Knowing What Has Been Done

One of the bad features of our modern business rush is the tendency to overlook the past and endeavor to go ahead on new lines without knowing what has been done before. We are all too fond of saying that we are not interested in ancient history, but only in what is new.

While this is a commendable spirit in many ways, there are very few inventors or manufacturers who cannot recall instances where valuable time and money have been wasted by not knowing or looking up a little ancient history.

A case has just come to our notice where a small manufacturer has, after spending considerable time and money, developed a very interesting little machine only to find that the same idea had been patented 14 years ago. This means that, so far as securing a commercial return for his investment, his time and money have been absolutely wasted.

Nearly all of the larger manufacturing organizations have everything of this kind looked up as soon as a new idea has been found by one of the experimental department and before any appreciable time or money has been spent on it. This investigation not only prevents reinventing an old device, but it also shows exactly what has been done along similar lines and gives many suggestions to all departments from the mechanical to the selling end of the organization.

If we would pause occasionally in our "mad careers" and endeavor to become somewhat familiar with the history of our particular line of business, we would find that in many cases, as was said by Oberlin Smith some years ago, "the ancients have stolen and used a great many of our inventions."

The history of machines might easily be a part of a course in machine design and could be so arranged as to take very little time, and yet familarize the students in a general way with what has been done before.

George W. Hebard

George W. Hebard, acting vice-president of the Westinghouse Electric and Manufacturing Company, died at his home in New York City on November 17.

The death of Mr. Hebard has removed from the electrical profession one of the pioneers of this industry. He was identified with the early history of the manufacture of electrical apparatus, becoming president of the United States Electric Lighting Company, of Newark, in 1882. He was connected with the early history of the generation and distribution of electric lighting in New York City as a director and stockholder of the United States Illuminating Company. The improvement of the system of distribution from the standpoint of the manufacture of the current was one of his most successful labors. At the time the United States company was taken over by the Westinghouse company, Mr. Hebard was president of the United company, and in the reorganization was made vice-president of the Westinghouse company; and, in 1888, when this company took over the Sawyer-Man company, Mr. Hebard was given charge of the newly acquired organization.

Mr. Hebard was 65 years of age and is survived by his wife and two children.

PERSONALS

Charles Churchill, of London, England, after a three weeks' stay in this country, sailed for home on the "Lusitania," November 29.

G. W. Dixon, formerly foreman of the Pope-Hartford Automobile Company, has accepted a position as general foreman with the Mercer Automobile Company, Trenton, N. J.

Albert Moore, member of the engineering firm of Woodman & Moore, Chicago, Ill., has recently become treasurer and general manager of the Shedd Electric Company, Roselle, N. J.

Seymour E. Hale, formerly manager of Hill, Clarke & Co., of Chicago, at their Cleveland branch, has now taken charge of the Rochester branch of Hill, Clarke & Co., Inc., Boston, Mass.

George E. Williamson, engineer of works, Union Metallic Cartridge Company, Bridgeport, Conn., has become chief engineer of the Strathmore Paper Company, Mittineague, Mass.

James H. MacLauchlan, until recently engineer of the American Cement Engineering Company, York, Penn., has organized the J. H. MacLauchlan Engineering Company, Baltimore, Md.

Sydney Beven, until recently foreman with the Rider-Ericsson Engine Company, Walden, N. Y., has accepted a similar position with the Matheson Automobile Company, Wilkes-Barre, Penn.

H. J. Elwert, until recently chief inspector of the Olds Motor Works, Lansing, Mich., has accepted a similar position with the Continental Motor Manufacturing Company, Muskegon, Mich.

John Spencer Camp, owing to ill-health, has resigned the presidency of the Pratt & Cady Company, Hartford, Conn. George Walworth Hayden, vice-president, has been elected to succeed Mr. Camp.

J. A. Doane, until recently superintendent of machine shops, American Optical Company, Southbridge, Mass., has been appointed manager of the Worcester Piston Ring and Machine Works, Worcester, Mass.

J. E. Stark has resigned as superintendent of the Western Wire Goods Company, which position he has held for the past four years, and has been elected president and general manager of the Electric City Manufacturing Company, Buffalo, N. Y.

F. A. Halsey, editor emeritus, AMERICAN MACHINIST, has also become an associate in mechanical engineering at Columbia University. Mr. Halsey will deliver a course of lectures during the coming winter embodying principles and features of practical machine-shop work, including the methods and principles underlying manufacturing processes which are beyond the scope of the college shop.

L. R. Pomeroy, until recently with the engineering firm of J. G. White & Co., and previously connected with the Safety Car Heating and Lighting Company, American Locomotive Company and General Electric Company, in various engineering capacities, has established an office as consulting engineer, with headquarters at 30 Church street, New York City. Mr. Pomeroy will give special attention to the design of railway and industrial plants, rehabilitation of shops, analysis of machine-tool operation with reference to electric and effective operation, and reports and appraisals of railway and manufacturing properties.

Shop Equipment News

New or improved machines, tools or shop appliances will be briefly illustrated and described here. A more full and detailed description will be given—if it can appear here first. ALL descriptions appear in ALL editions of the paper—American, Weekly English and Weekly German

Bristol's Frictionless Ink Type Recording Instrument

To meet the demand for a frictionless ink type recording instrument to accurately record fractions of millivolts and adapted for use as a recording electric pyrometer, the instrument illustrated herewith has been developed and placed upon the market by the Bristol Company, Waterbury, Conn.

Fig. 1 is an interior view showing the galvanometer movement case hinged to the back of the instrument and carrying the inking pad in front of the recording arm.

Fig. 2 shows the sensitive electrical movement swung to one side for convenience in removing the record and inserting a fresh chart. A capillary gold tube open at both ends is carried at the end of the recording arm at right angles to the surface of the chart. The inking pad is suspended from the case of the electrical movement and is curved to correspond with the arc covered by the motion of the end of the recording arm.

When the movement is swung back into its operating position as shown in Fig. 1, the recording arm can swing free, accommodating itself to the position corresponding to the delicate current which is to be measured. The clock which revolves the chart at the desired speed also automatically presses the inking pad toward the chart every ten seconds, bringing one end of the capillary tube into contact with the chart, and the other end simultaneously into contact with the inking pad. A fine dot of ink is left on the chart and the capillary tube is replenished with ink from the pad. The recording arm thus carries a constant supply of ink, and its perfect balance, which is very important, is always maintained. The electrical movements used in these recorders are made especially for the purpose by the Weston Electrical Instrument Company.

Although the most important applications of these recording instruments have been for pyrometers, they have also been used for electrolytic research, recording voltmeters and recording shunt ammeters.

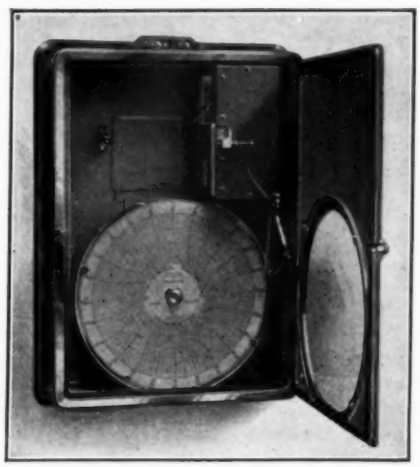


FIG. 2. MOVEMENT SWUNG TO ONE SIDE

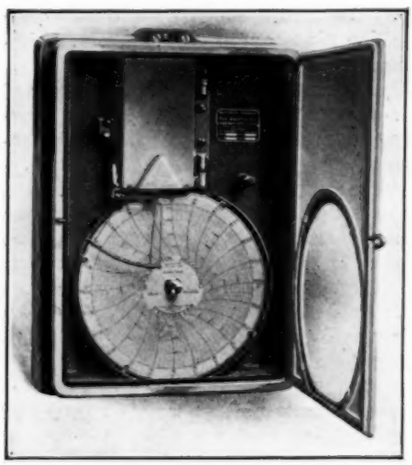


FIG. 1. MOVEMENT IN OPERATING POSITION

Safeguard for Punch Press

An automatic guard to prevent punch-press operators from getting their fingers or hands caught between the punches and dies, is manufactured by the H. and A. Lock Company, 156-170 Fifty-third street, Brooklyn, N. Y.

This guard has much to recommend it in simplicity, effectiveness and wide range of applicability. It is operated entirely by the regular pedal trip, and is so set that the clutch is not thrown in until the guard is raised to a nearly vertical position.

As shown in Fig. 1, the guard lies perfectly flat, on a level with the top of the die when not in use, and so does not interfere in any way with the operator's handling of work.

The action of the guard is better shown in Fig. 2, where it is shown partly raised. In this halftone *A* is the rod connecting with the pedal; *B* the rod connecting with the clutch; *C* is a bell crank bolted to the regular rocker *D* and connected by rod *E*, to the short crank lever F operating the guard *G*.

As the foot pedal is pressed the guard raises until in the position shown in Fig. 3, when the clutch acts and the press is tripped. It is impossible to trip the press when the guard is down, as inspection of the device will show.

The adaptability of the guard is shown by the fact that the rod *H* may be made

FIG. 1. GUARD AT REST ON A LEVEL WITH TOP OF DIE

any length; the studs *I* may be adjusted to suit the hight of any die, and any length or shape piece necessary may be bolted to the brackets *J*; only two holes need to be drilled and tapped in the bolster or bed plate and only one lever, the bell crank, needs to be bolted to the regular tripping mechanism.

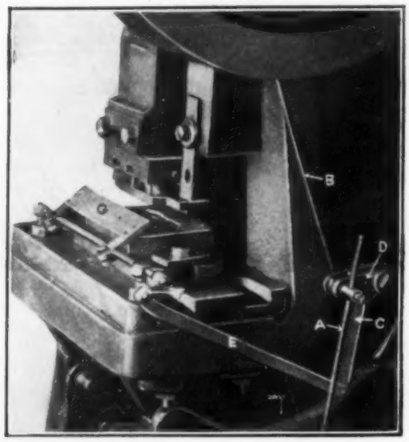


FIG. 2. PARTLY RAISED BUT PRESS NOT TRIPPED

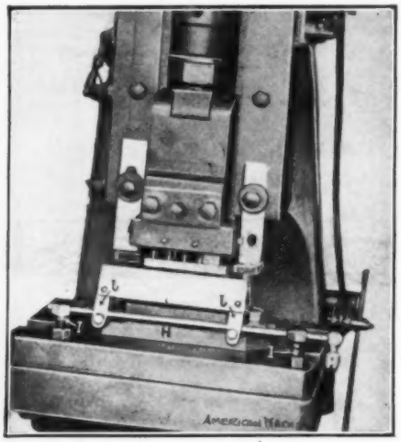
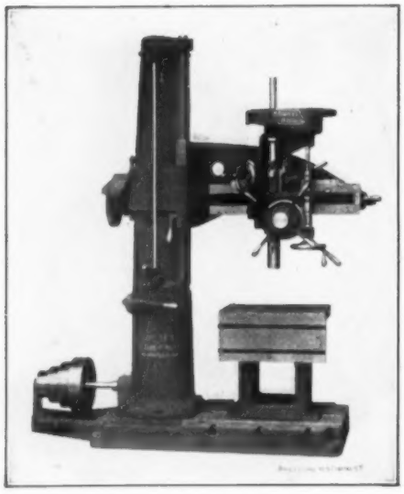


FIG. 3. VERTICAL POSITION AND RAM READY TO DESCEND

A Radial Driller

The halftone shows a radial driller built by the Dreses Machine Tool Company, Cincinnati, Ohio. This machine is built in two sizes, 31 and 36 inches. It is simple in design as it is intended for use in repair shops and where the more complicated machines are not desirable.



A RADIAL DRILLER

The table can be slid on the base so as to make it available for the full horizontal traverse of the spindle on the arm.

The spindle has a ball thrust bearing. It is started, stopped and reversed by the lever shown at the right side under the arm. An automatic stop and graduated depth gage are provided. The feed is all geared, has four changes, from 0.007 to 0.023 inch per turn. It is controlled by a nurled shifting collar on the feed rod.

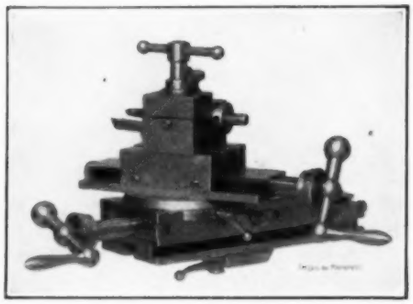
Eight spindle speeds, from 16 to 390 turns per minute, are provided. The head is moved on the rail by rack and pinion and clamped by the handle shown above the rail.

The table is provided with a side apron, as shown, and with a tool shelf on the inside.

A Compound Slide Rest for Bench Lathes

The halftone shows a new compound slide rest manufactured by the Stark Tool Company, Waltham, Mass. It is equipped with micrometer set stops on each of the feed screws so that very close adjustments can be quickly obtained. The swivel is turned on a bevel and is easily set. It is graduated to degrees.

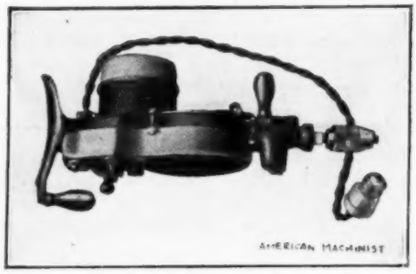
The tool post shown in place will hold either round or square turning and boring tools. The turning tool is clamped between two rockers and the boring tool is held in an eccentric quill which provides for adjusting the tool when setting it to the center of the work. The rest is also supplied with the plain tool post.



A COMPOUND SLIDE REST

Electric Breast Driller

The motor-driven breast drill shown herewith can be run with either direct or alternating current and is reversible, a handy feature for tapping. The switch is entirely incased and a convenient feature of the drill is a spindle lock. This consists of a break-over movement to the spindle sleeve, whereby the spindle is brought into locking position. The spindle in this position is held from turning by jaws on the main frame, thus making it easy to tighten the chuck to any extent required, either by hand or by the use of a chuck spanner.



AN ELECTRIC BREAST DRILLER

The drill has a capacity up to ⅜ inch, weighs 12½ pounds and is a recent product of the Temco Electric Motor Company, Leipsic, Ohio.

A Single Spindle Cylinder Borer

The halftone shows a new cylinder borer, built by the Moline Tool Company, Moline, Ill.

This machine, as shown in the cut, is intended for boring single or twin cylinders. It is provided with a compound table so that two or more cylinders may be bored at one setting. It can also be furnished with a plain table. The compound table is provided with a screw traverse, adjustable stops and clamping screws, so that it can be quickly set in any desired position.

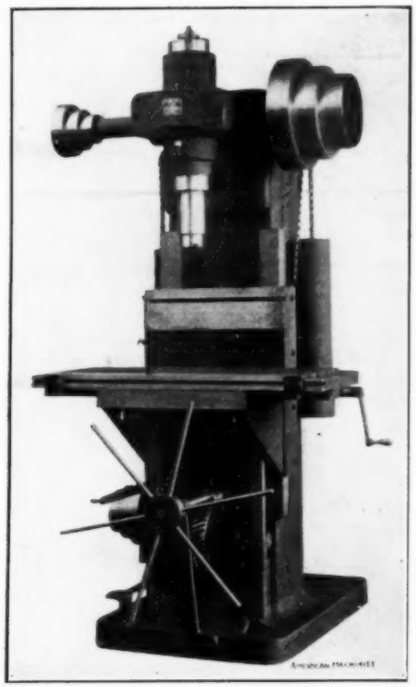
The spindle is 3$\frac{11}{16}$ inches diameter, bored No. 6 Morse taper and has a slotted end for driver. It is hollow and is provided with a draw-in and knock-out rod, the thrust is taken on ball bearings.

The bearings are of phosphor bronze, the lower one tapered, the upper one being vertically adjustable to take up wear in the taper bearing.

The drive is by 4-pitch, phosphor-bronze spiral gear, meshing with a hardened-steel pinion. The drive is direct from the cone pulley.

The machine is provided with a double-speed countershaft, giving six changes of speed. The knee extends about equally above and below the surface of the work table and travels on square guides, provision being made for taking up wear

in both directions. The extended face of the knee above the table is provided with a T-slot, so that jigs can be bolted to the back of the knee as well as to the table.



A SINGLE-SPINDLE BORER

The feed is by double steel rack and pinions, the racks being set under the center of the table, so that there is practically no side strain. The feed pinions are cut integral with the feed shaft, which is driven by bronze spiral gearing, with a further reduction by worm gearing.

The table is counterbalanced, provided with automatic stop and quick return by the pilot wheel. The greatest distance from the nose of the spindle to the table is 32 inches; distance from face of knee to center of spindle, 9 inches; vertical travel of table, 24 inches; cross travel of table, 20 inches; size of working face of table 18x36 inches; the table has four T-slots for ⅝-inch bolts. The machine weighs about 6200 pounds.

Automatic Controllers for Motor Driven Machinery

The Electric Controller and Manufacturing Company, of Cleveland, Ohio, has recently placed on the market a line of automatic controllers designed for the control of motor-driven machinery.

The controller consists of a small operator's switch, shown at *A*, in Figs. 1 and 2, and an accelerating unit.

The controllers are built in three types to secure: Non-reversing and dynamic braking; reversing without dynamic braking; reversing and dynamic braking. In each type a variety of four different forms of accelerating units are offered. These accelerating units vary in their design from a simple train of accelerating switches to a unit having a fused service switch, a train of accelerating switches, and complete circuit-breaker features.

The accelerating unit automatically accelerates or decelerates the motor through the action of series-wound accelerating switches which also act as current-limit relays. When the current in the winding of one of these switches exceeds a predetermined value the switch locks open and cannot close until the current is reduced to the proper value.

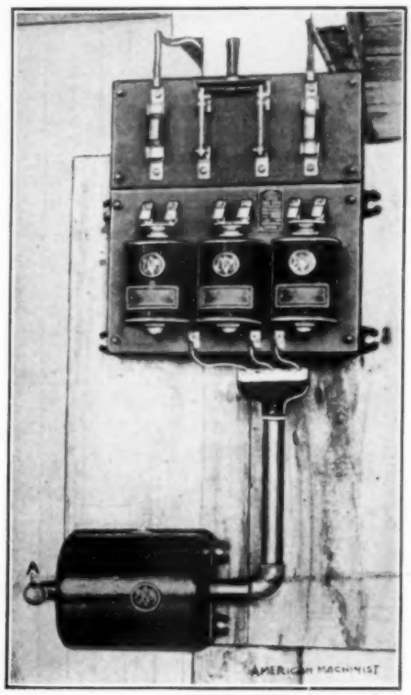


FIG. 1. THE AUTOMATIC CONTROLLER

When the operator's switch is thrown to the running position, current flows through the motor, all of the starting resistance, and the coil of the first series-wound accelerating switch. As the motor accelerates the current drops, and when it reaches the correct value the first accelerating switch closes, cutting out a portion of the starting resistance. The succeeding accelerating switches operate similarly, ultimately cutting out all of the starting resistance and putting the motor across the line. By throwing the operator's switch to its original position, the motor is disconnected from the line and stops. Different positions of the handle of the different types of operator's switch provide for drifting, reversing or rapid stopping by dynamic braking.

Dynamic braking is secured by a change of connections, accomplished by the operator's switch, which first inserts all the starting resistance in series with the armature. The motor is then quickly and evenly brought to rest by automatic dynamic braking, the accelerating switches, in this case, acting as decelerating switches by cutting out, step by step, the resistance as the current, generated by the motor, decreases due to the slowing down of the motor.

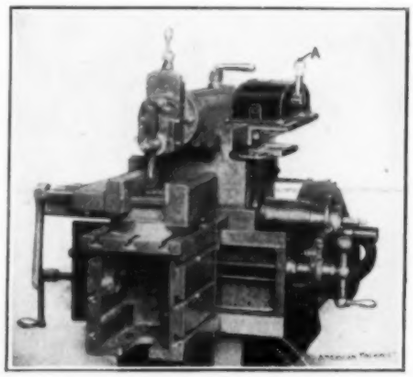


FIG. 2. THE DEVICE APPLIED TO A SHAPER

Thread Miller

The accompanying halftone shows an improved model of thread miller recently developed by the Waltham Machine Works, Waltham, Mass.

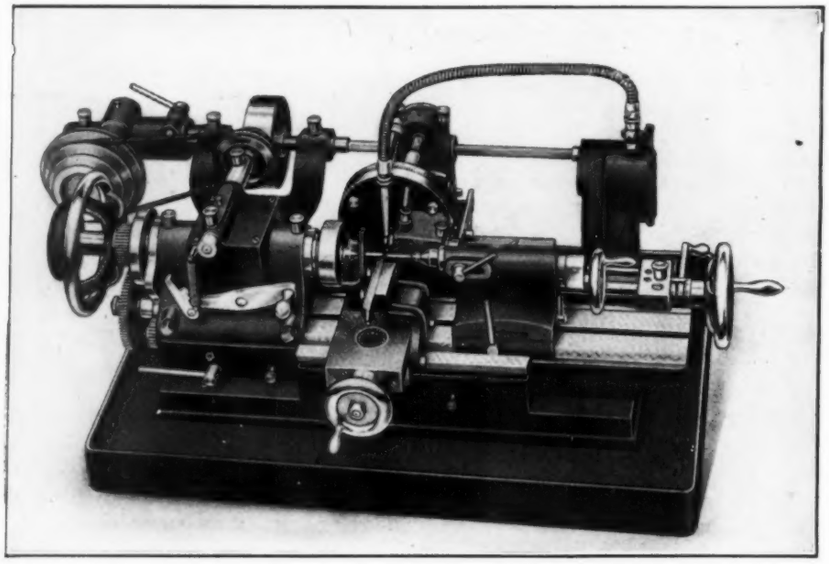
As will be noted, the machine is mounted on a pan base of sufficient depth at the lower right-hand corner to hold a supply of oil. The oil, after it leaves the cutter, falls into a receptacle on the cross slide, from which a channel leads it to the rear of the machine close to the oil reservoir.

The machine is driven from a constant-speed shaft attached to brackets on the rear. This shaft drives the cutter spindle through a quick-pitch worm and gear sliding on squared portions of both the constant-speed shaft and the driving shaft for the cutter head. The right end of the constant-speed shaft is connected to a pump that supplies the oil to the work with the shaft running in either direction. On the bracket that serves as the support for this shaft is mounted a shaft at right angles, driven by means of a quick-pitch worm and gear belted to the work spindle on the headstock through four-step cone pulleys. These pulleys are interchangeable, and 10 different feeds can be obtained. The support for the feed-driving shaft can be adjusted longitudinally to facilitate the easy shifting of the belt and to secure proper tension.

The clutch that is automatically released when the machine has reached the completion of the cut is placed directly on the work spindle, and a large handwheel is provided on this spindle so that the carriage can be returned to the starting point by means of this handwheel without disengaging the gearing.

The gearing, however, can be disengaged if desired and the carriage returned by hand.

The tailstock has a cross slide so that tapers too slight to be obtained by the taper attachment, can be cut or the alinement of the centers can be rectified if needed.



IMPROVED MODEL OF THREAD MILLER

The compensating bar for varying the lead of the screw is altered so that sufficient variation can be obtained to allow for shrinkage in hardening, etc. A pointer attached to the swiveling bar reaches through to the graduated index on the front of the machine and shows the amount of increased lead that can be obtained. The bar can be swiveled by moving two thumb screws in the front of the machine.

The right-hand bearing of the lead screw is threaded and this bearing can be rotated by a lever and thus change the location of the carriage in relation to the cut, making a fine adjustment for locating the cutter to work previously milled.

Work three inches in diameter can be handled in this machine if the thread is of not too coarse pitch. The bed has also been extended so that longer work can be held on centers and the travel of the carriage increased from 6 inches to 7¼ inches.

Surface Grinder

The design and construction of the surface grinder shown herewith will be apparent from the halftone.

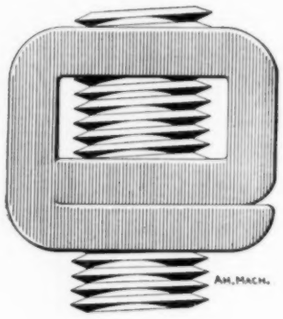
The grinding wheel operates in both directions. The spindles are crucible steel, turned and ground, and have adjustable self-oiling bearings. The table has three T-slots and power feeds to both longitudinal and traverse motions. The travel is automatic, and automatic power feed is obtained by throwing in the clutch which operates at each end of the stroke. Vertical motion is obtained by hand by means of a screw fitted with a dial graduated to thousandths.

The working capacity of the machine is 36 inches long, 10½ inches wide and 12 inches high. It carries a wheel 10x1½ inches, travel of table 16 feet per minute and the countershaft speed is 315 revolutions per minute.

This machine is a recent product of the J. A. Stowell Company, Leominster, Mass.

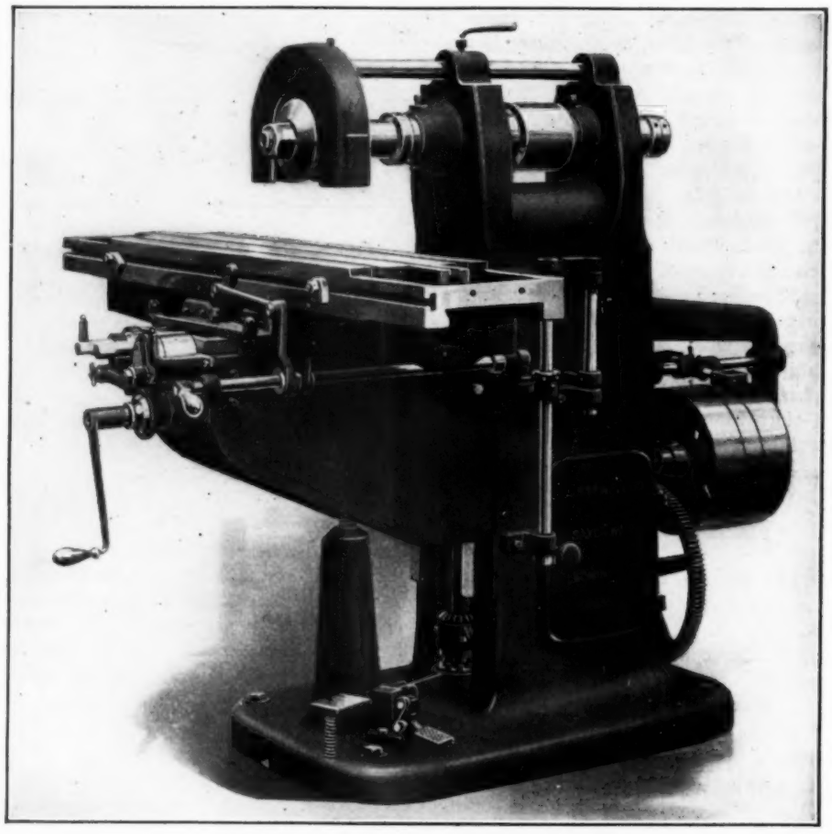
Loop Nut

The form of nut shown in the accompanying line cut consists of a strip of steel folded as shown, leaving a lateral opening and giving sufficient tension to throw the threaded ends slightly out of alinement, thus taking up slack between the bolt and nut.



LOOP NUT

This form of nut was designed for uses where the more usual jam nuts and spring washers are used, and is manufactured by the Loop Nut Manufacturing Company, Madison, Wis.



A NEW "SAXON" PLAIN SURFACE GRINDER

High Duty Hobbing Machine

The high-duty hobbing machine shown in the accompanying halftone has a single-pulley drive with an adjustable guard.

The single-pulley drive imparts a constant speed to the driving pulley with maximum power at all times and the changes of speed are obtained by means of change gears where 10 changes are provided. This enables the operator to select the proper speed for the hob he is using whether it is large or small, or made of carbon or high-speed steel and for cutting the various metals. Therefore when using small-diameter hobs the speed of the machine can be increased as these hobs may run at higher number of revolutions per minute than large-diameter hobs.

The machine is equipped with an automatic stop which enables the operator to set the cutter-slide trip dog at the proper position, so that when the gear is finished, the entire mechanism of the machine will be stopped automatically with the exception of the driving pulley, a feature exceptionally useful in cutting helical gears. If the feed is accidentally or otherwise thrown out before the gear is finished, the entire mechanism of the machine is stopped. This feature also enables the operator to feed up to a shoulder or line in cutting a helical or spur gear where the feed can be automatically stopped at the same point on every blank, thus making the work uniform. With this automatic stop one operator can look after more machines. All running gears are inclosed with guards.

This machine is a recent development of Gould & Eberhardt, Newark, N. J.

Large Shockless Jarring Machine

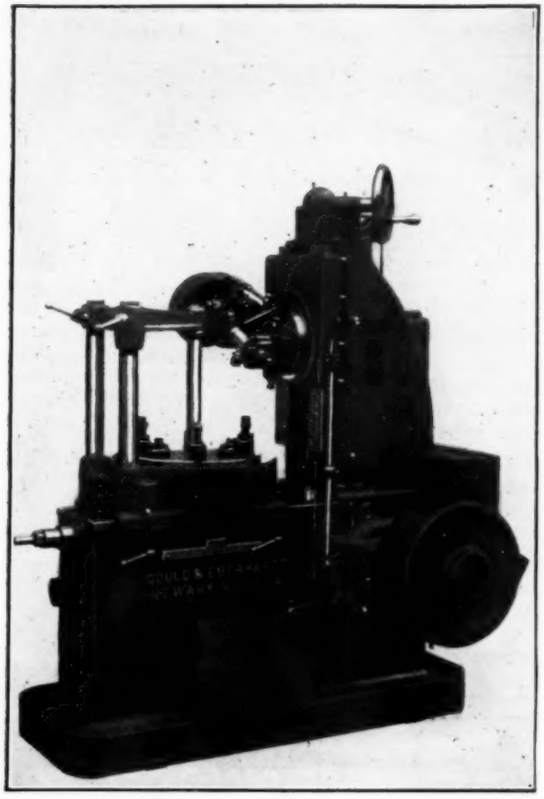
The accompanying halftone shows a jar-ramming molding machine, of the shockless type, reported to be the largest ever built.

It is equipped with a steel table 8x12 feet, with cylinder attached 36 inches in diameter and is mounted upon a plunger base of cast iron weighing about 65,000 pounds. This is fitted in the cylinder base 5 feet in diameter and rests upon 22 helical steel springs, aggregating over 3000 pounds in weight. The total weight of the machine is between 90,000 and 100,000 pounds.

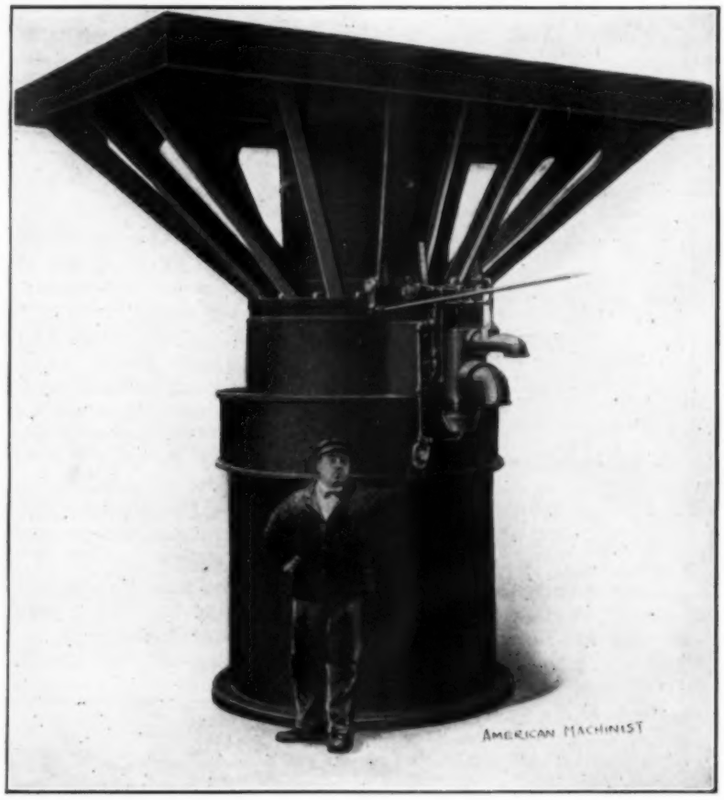
The stroke is adjustable from 1 to 4 inches, and this adjustment can be made while the machine is running. The machine is to be used for ramming up molds from 6 to 8 feet wide and 12 to 18 feet long, weighing anywhere within the rated capacity of 50,000 pounds. I-beams will be used to extend the length of the table and carry a false table on top, on which the patterns are placed, by which means it is expected that molds 18 feet long can easily be rammed. The machine is a recent product of the Tabor Manufacturing Company, Philadelphia, Penn.

A Four Spindle Cylinder Borer

The halftone shows a new cylinder borer built by Baker Brothers, Toledo, O., for boring *en bloc* automobile cylinders. On the machine shown the four spindles are each 4 inches center to center, and the drive is sufficiently powerful to rough bore a block of four 3¼-inch diameter cylinders 10 inches deep in 1½ minutes and finish it in one minute, the usual operations being rough boring, straighten boring and finish reaming. The horizontal shafts are all provided with Hess-Bright D. W. F. annular bearings and the vertical shafts with Hyatt high-duty roller bearings. Thrusts are all taken on ball bearings. The drive itself is through a simple train of spur and bevel gears. The gears are all made of a high-grade steel, hardened. In order to insure alinement of the spindles they are provided with bronze taper bearings with provision for adjusting for wear. In operating, the action of the machine is semi-automatic. A cylinder is chucked and the starting lever shown at the upper right hand of the machine is thrown in. This engages the



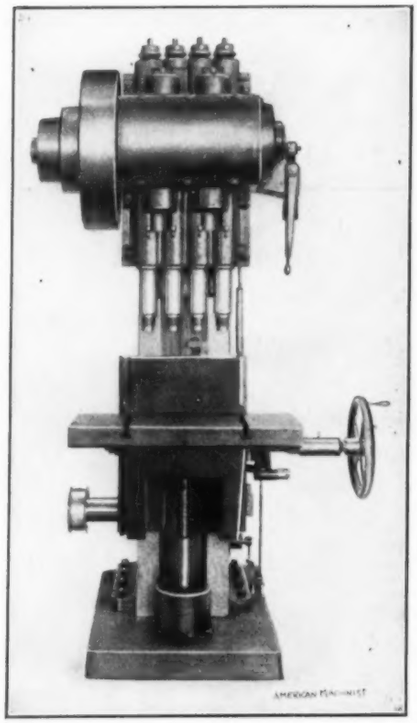
AUTOMATIC HOBBING MACHINE



LARGE SHOCKLESS JARRING MACHINE

driving clutch, starting the spindles and also throwing in the feed. The table feeds up with the work until the proper depth is reached, when it automatically trips, the spindles stop revolving and a quick-return feed is thrown in, backing the work away from the cutters and stopping when clear. The entire feeding train consists of hardened gearing with shafts running on Hess-Bright annular ball bearings and thrust taken by ball bearings.

The table is gibbed between the inner surfaces of the ways on the column, and a long taper gib is provided to take up wear.



A FOUR-SPINDLE CYLINDER DRILLER

A Relieving Lathe

Fig. 1 shows a new relieving lathe built by the Hamilton Machine Tool Company, Hamilton, O.

In general details this lathe is identical with the standard 14-inch lathe built by the same concern.

The relieving device is not an attachment but forms a part of the lathe itself. With it work can be relieved up to the greatest capacity of the lathe between centers.

Figs. 2 and 3 show a plan of the relieving mechanism in the carriage.

Referring to the line cut, Fig. 3: The coiled spring *A* is adjusted by means of a screwdriver and is provided with a lock nut. It should be so adjusted as to maintain an even pressure of the cam link *C* against the cam *B*. The cam *B* is driven by means of gearing from a splined shaft at the back of the lathe. Three of these cams are provided with two, three and four lobes, so that cutters having from 2 to 16 teeth can be relieved. These cams are easily removed after releasing the tension on the spring *A*, as they are held in place by a screw and washer.

The cam link *C* is held against the cam by the tension of the spring *A* as previously stated.

The adjusting block *D* is to vary the amount of relief, which is from $\frac{1}{32}$ to $\frac{1}{16}$ inch. The variation is obtained by adjusting the block *D* to or from the fulcrum of the cam link *C* by means of the screw *E;* the further the block *D* is from the fulcrum the greater the traverse of the slide.

The gear *F* is the adjusting gear and is used for "timing" or setting the work in proper relation to the tool so that the "kick back" will take place at the right moment. By loosening the two T-headed bolts the spindle can be turned by hand without changing the position of the cam.

The screw *G* is a short screw used when relieving. When this is removed and a longer screw, which is furnished, is put in its place the lathe is converted into a standard lathe.

All shafts in the carriage run in hardened and ground bearings and are provided with hardened and ground thrust washers. The cross-feed and compound-rest screws are provided with double nuts for taking up wear. Draw-back collet attachment is furnished which takes round stock up to 1 inch diameter.

The machine shown will relieve all straight and taper work, such as taps, hobs and reamers, also all straight and angular-faced mills up to 10 inches in diameter with any number of teeth from two to sixteen. It is not confined to outside relieving but will do internal work as well, such as hollow mills. If desired, the 16-inch lathe built by the same concern can be supplied with this new relieving device.

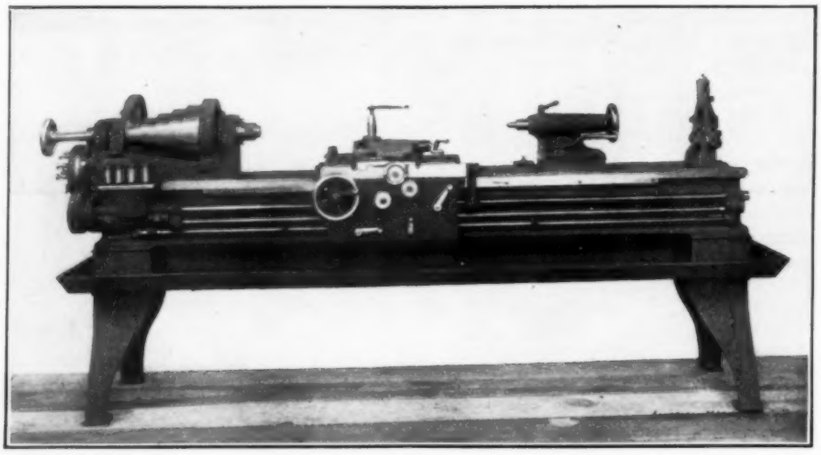


FIG. 1. A RELIEVING LATHE

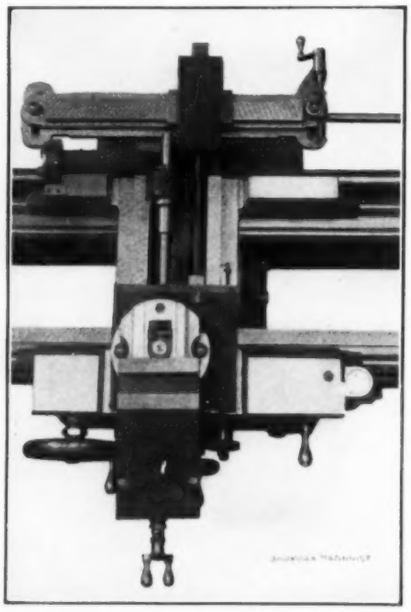


FIG. 2. THE RELIEVING MECHANISM

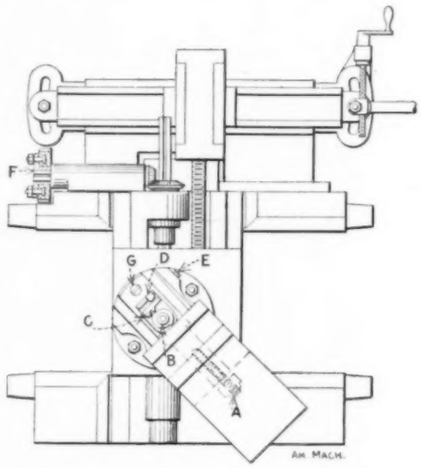


FIG. 3. DETAILS OF THE RELIEVING MECHANISM

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The American Car Sprinkler Company, Worcester, Mass., is to erect a machine shop in that city.

Bryant & Chapman, Hartford, Conn., will erect a new creamery on Homestead avenue and Woodland street.

The machine shop of the Boston (Mass.) Elevated railway, at 439 Albany street, was burned. Loss, $10,000.

The Vanderman Manufacturing Company, of Willimantic, Conn., making castings, is erecting a new factory.

George B. Parsons, Bristol, Conn., is erecting a new commercial garage which will be equipped with modern appliances.

Contracts will soon be awarded for an addition to the plant of the New Haven (Conn.) Boiler Works on Saltonstall avenue.

The Chase Rolling Mill Company, of Waterbury, Conn., will build a new rolling mill on Thomaston avenue, Waterville, Conn.

Contract has been awarded for the erection of a one-story addition to the plant of the Worcester (Mass.) Pressed Steel Company.

Fire did about $10,000 damage to the machine shop of the Boston Elevated railroad, Albany street and Harrison avenue, Boston, Mass.

Permit has been granted for the erection of an addition to the plant of the American Steel and Wire Company, on Fairmount avenue, New Haven, Conn.

The Hart & Hegeman Manufacturing Company, Hartford, Conn., manufacturer of electrical supplies, will build an addition to its plant on Capitol avenue.

The Shaw-Lundin Auto Company has been organized at Kittery, Me., for the manufacture of automobiles. Burton W. Shaw, Newton Center, Mass., president.

The H. H. Matthews Manufacturing Company, of Seymour, Conn., will build a new two-story factory. The concern manufactures bicycle parts and store trimmings.

The Coin-Operated Machine Company, of Boston, Mass., has been incorporated with a capital of $50,000. S. Woodberry, W. R. Farland and I. S. Lundin are incorporators.

The Titan Tractor Company, Augusta, Me., has been incorporated to manufacture and deal in traction engines. Capital, $1,000,000. E. J. Pike, president; L. J. Coleman, treasurer.

Kirk & Co., Temple street, New Haven, Conn., has awarded the contract for a new garage to be erected at 215 Crown street, to cost $40,000. Modern equipment will be installed.

The Traut & Hine Manufacturing Company, New Britain, Conn., manufacturer of glove clasps, brass clips, etc., will equip its plant for the manufacture of safety razors at an early date.

The Worcester Manufacturing Company, Worcester, Mass., manufacturer of door checks, has increased its capital stock and will enlarge its plant immediately. New machinery will be required.

The C. A. Hamel Company, Lynn, Mass., has been incorporated with a capital stock of $50,000 to manufacture shoe machinery. Incorporators are C. A. Hamel, C. Colburn, T. C. Rowen and H. E. Miller.

The Waterbury Metal Products Company, of Waterbury, Conn., has been incorporated to manufacture novelties in metal. Capital, $12,000. Incorporators, Fred H. Goppelt, Jr., J. M. Burrall, John B. Wallace, Jr., all of Waterbury.

Connecticut Metal and Chemical Company, of New Britain, Conn., has been incorporated to do melting and refining and contracting. Capital, $50,000. Incorporators, E. A. Moore, William S. Rowland and J. E. Cooper, of New Britain.

Lewis H. Warner Company, of Orange, Conn., has been incorporated to make and deal in hardware, etc. Capital, $25,000. Incorporators, Lewis H. Warner, of Orange; George E. Tucker and Albert H. Powell, both of New Haven.

The Brown Speedometer Company, New Britain, Conn., has organized with $200,000 capital to manufacture speedometers. A complete floor of the Corbin Screw Corporation's plant has been acquired. President, Charles Glover; vice-president, Clarence A. Earl; secretary, George P. Spear.

MIDDLE STATES

The Scripps Motor Company, of Detroit, Mich., manufacturer of marine engines, is to erect an addition to its factory.

The Crowe Fame Plate and Engraving Company will build a one-story factory at 1729 Grace street, Chicago, Ill.

The Lockwood-Ash Motor Company, Jackson, Mich., manufacturing marine motors, is erecting an addition to its plant.

Henry Disston & Sons, manufacturers of saws, have let contract for a two-story addition to their plant at Tacony, Penn.

The American Brake Shoe Company, 4544 West Twenty-sixth street, Chicago, Ill., will build a two-story addition to its plant.

The Iroquois Iron Company, Ninety-third street and Lake Michigan, Chicago, Ill., will build a one-story addition to its works.

The machine shop of the Philadelphia & Reading railroad at Ninth and Fairmount avenue, Philadelphia, was destroyed by fire.

The Milwaukee (Wis.) School and College of Aviation will erect a foundry and machine shop on the aviation field at West Allis.

The plant of the Lehigh Valley Structural Steel Company, Allentown, Penn., was almost totally destroyed by fire. Loss, $25,000.

Fire damaged the plant of the Firth-Sterling Steel Company, at Demmler, Penn., to the extent of $10,000, the pattern shop suffering most.

The Chicago (Ill.) Commercial Car Company will build a one-story factory at 5853-55 Evanston avenue and equip it with new tools.

The Bulmer Auto Garage Company, Bound Brook, N. J., is erecting a two-story building for general machine shop and automobile supplies.

The city of Cleveland, Ohio, will erect a machine shop at the Boys' Home. Information can be had of F. G. Hogen, director of public safety.

A permit has been issued for the erection of a garage to cost $7000 for E. Mohr, on Fifty-fifth street, south of Chester avenue, Philadelphia, Penn.

Contract has been awarded for the erection of an addition to the plant of the Valley Grey Foundry Company, at Bristol and Water streets, Saginaw, Mich.

A. N. Russell & Sons' Company, Ilion, N. Y., is reported to have decided to enlarge its plant at that point the coming spring. It manufactures stove parts.

J. A. Sheppard & Co. have purchased a site at Erie avenue and Sepviva street, Philadelphia, on which they will erect a modern plant to manufacture stoves.

The Hart Grain Weigher Company and the Hart Foundry Company are planning extensive additions to their plants at North Water and Eaton street, Peoria, Ill.

J. H. Williams & Co., of Brooklyn, N. Y., manufacturing drop-forged products, will locate in Buffalo, N. Y., where a new plant to cost $1,000,000 will be erected.

The Hamilton Manufacturing Company, Two Rivers, Wis., manufacturer of wood type and printers' furniture, will engage in the manufacture of steel and metal furniture.

The Harder Auto Truck Company, Chicago, Ill., has been incorporated to manufacture vehicles, etc. Capital, $100,000. Incorporators, Henry P. Chandler, J. M. Johnston, K. Cornwell.

Stevens Motor Truck Company, Chicago, Ill., has been incorporated to manufacture motor trucks, automobiles, etc., by George P. Stephens, Louis F. & Agnes M. Stevens. Capital, $10,000.

The plants of Manzel Brothers, makers of automatic oil pumps, and the Reliable Metal Stamping Company, at 317-319 Babcock street, Buffalo, N. Y., were burned. Loss, about $70,000.

The Buchanan Manufacturing Company, Eldorado, Ill., has been organized to manufacture woven wire fence stretchers. Capital, $15,000. Incorporators, C. C. Buchanan, J. N. Buchanan, Roy Gregg.

The Griffith Manufacturing Company, Griffith, Lake county, Ind., has been incorporated with a capital of $20,000 by B. B. Potter, I. W. Hough, W. J. McFarland and others, to manufacture metal castings.

The plant of the Advance Thresher Company, Battle Creek, Mich., has been sold to New York capitalists, and between $2,000,000 and $4,000,000 will be expended in doubling the capacity of the plant.

The United Electrical Supply Company, Marion, Ohio, has been incorporated with $10,000 capital to do a general electrical construction business by A. J. Berry, Frank D. Glasser, Jessie H. Glasser, etc.

Car Seal and Equipment Company, Chicago, Ill., has been organized to manufacture car seals, locks and other devices by Lawrence C. Weyand, Alexander Prussing, Van H. Battenburg. Capital, $100,000.

The Federal Motor Car Company, Chicago, Ill., has been organized to manufacture and deal in automobiles, trucks, etc. Capital, $10,000. Incorporators, Carey W. Rhodes, David S. Rosenthal, Leo S. Kositchek.

Empire Auto Top and Supply Company, Chicago, Ill., has been incorporated to manufacture and deal in automobiles and automobile parts. Capital, $20,000. Incorporators, Henry Graff, Jr., Albert N. Charles, Joel E. Bullard.

The Acme Automatic Tire Pump Company, Chicago, Ill., has been incorporated with $50,000 capital to manufacture automatic tire pumps, etc. Incorporators, Francis J. Carroll, Emil R. Rosenthal, Francis J. Houlihan.

The Perfection Storage Battery and Lighting Company, Chicago, Ill., has been organized to manufacture electric generators, automobile appliances, etc. Capital, $50,000. Incorporators, Carl E. Witters, George Lyons, John Walhake.

The Precision Lubricator and Manufacturing Company, Chicago, Ill., has been organized with $21,000 capital to conduct a brass and iron foundry and machine shop. Incorporators, John Stuart Roberts, Emerson B. Stoddard, C. M. Adams.

SOUTHERN STATES

The Dixie Manufacturing plant will erect an addition to its plant at Russel and Stockholm streets, Baltimore, Md. The concern manufactures exhaust fans, dust collectors, etc.

WEST OF THE MISSISSIPPI

The Santa Fe railway will build a new roundhouse and shops at East Hutchinson, Kansas.

The Standard Wire Fence Company, Oakland, Cal., has taken out a permit to build an addition to its plant.

Dover & Wilson, Taft, Cal., will establish a commercial garage and repair plant. Modern machinery will be installed.

A. Hartlerode, Paisley, Ore., will build a commercial garage and repair plant. Modern equipment will be installed.

The Moran Company, of Seattle, shipbuilders and iron works, will spend about $1,000,000 in new buildings and machinery.

Nelson Dennis, Edgewood, Cal., has acquired a site at Dorris, Cal., and will build a modern commercial garage and machine shop.

O'Reilly & Burpee, Portland, Ore., will build a commercial garage and repair shop on East Water street. About $16,000 will be expended.

The Universal Wrench Company, Portland, Ore., plans for the erection of a plant near Portland for the manufacture of a patent wrench.

Simon Klovdahl, Springfield, Ore., will build a commercial garage and repair plant on Main street. Modern equipment will be installed.

The Flathead Interurban railway (electric), Kalispell, Mont., recently organized, plans for the erection of car shops. A. L. Jaqueth is engineer.

E. C. Newport, Hanford, Cal., will establish a commercial garage and repair plant at Dos Palos, Cal. Modern machinery will be installed.

Knight & Twining, Kalispell, Mont., will erect a commercial garage and repair plant on East First avenue. Modern equipment will be installed.

The Payne-Parsley Machine and Manufacturing Company, Crockett, Tex., will rebuild its cotton-chopping machine factory, recently destroyed by fire.

The Brisco Iron Works, Lindsay, Cal., plans for the erection of a plant at Porterville, Cal. The company manufactures deep-well pumping machinery.

The Southern Pacific Railroad Company, San Francisco, Cal., has taken out a permit at Portland, Ore., to build a new car shop on East Twenty-second street.

The Atlas Gas Engine Company, Twentieth avenue, Oakland, Cal., will build a new machine shop and a new pattern shop. Modern equipment will be installed.

The Armstrong Machinery Company, Spokane, Wash., building ice and refrigerating machines, has increased its capital and will install additional equipment.

T. Connolly, Thirty-seventh place, Los Angeles, Cal., has taken out a permit to build a new foundry plant on San Pedro street. The plant will be fully equipped.

Fred Espe, South Main street, Los Angeles, Cal., will build a new commercial garage and repair plant on Main, near Washington street. Modern equipment will be installed.

The Pomona (Cal.) Manufacturing Company, manufacturer of pumps, valves and kindred products, has taken out a permit to build a new foundry on Bertie street.

The Portland (Ore.) Railway, Light and Power Company has commenced the erection of new buildings to consist of machine shop, foundry, blacksmith shop, car shop, etc.

H. P. Barnhart, Portland, Ore., has acquired property on Twenty-first street, in the Parkrose district, and plans for the erection of a commercial garage and repair plant.

Charles Page and B. F. Rice, of Tulsa, Okla., contemplate the establishment of a rolling mill of 40 tons daily capacity for manufacturing structural and railroad iron and steel.

The S. & M. Lamp Company, Los Angeles, Cal., has leased property on South Figueroa street, and will establish a plant for the manufacture of automobile lamps and radiators.

The Oscar Krenz Copper and Brass Works, Folsom street, San Francisco, Cal., has taken out a permit to erect a new two-story machine shop. Modern machinery will be installed.

The Limacon Pump and Motor Company, Phœnix, Ariz., has filed articles of incorporation with a capital of $1,000,000. B. Walthen, William Charlton, Sloan Simpson and T. C. Weaver, all of Dallas, Tex., and Frank Reaugh, Oak Cliff, Dallas, Tex., are incorporators. The company plans for the establishment of a plant for the manufacture of patented pumps, motors and allied machinery.

CANADA

Canadian Brakeshoe Company will locate a plant at Sherbrooke, Que.

The Guelph Stove Company, of Guelph, Ont., will double its plant.

The Nova Scotia Car Works will increase its plant at Amherst, N. S.

The Hamilton Bridge Works will build a $30,000 addition to its plant.

The Battleford Iron Works Company will locate a plant at Battleford, Sask.

The Purdom Hardware Company's plant at London, Ont., was destroyed by fire.

The A. R. Whittall Company will build an extension to its can factory at Montreal.

The Fredericton Nutlock Company will locate a new factory at Fredericton, New Brunswick.

The Western Foundry Company, of Wingham, Ont., contemplates a big addition to its plant.

The Canadian Ornamental Iron Company, of Toronto, will purchase additional machinery.

The Central Pacific railroad will erect $150,000 roundhouse at Kerrobert, Sask., Canada.

Harry Weaver will equip a $25,000 garage and repair shops at 85 St. Famille street, Montreal.

The Saskatchewan Bridge and Iron Company will locate a new plant at Moose Jaw, Saskatchewan.

The British Columbian Screen and Manufacturing Company will locate a new factory at Vancouver, B. C.

The Yorkton Auto and Garage Company will equip a big new garage and repair shops at Yorkton, Sask.

General Manufacturing

NEW ENGLAND

Fire destroyed the canning factory of Thorndike & Hix, at Union, Me.

Littleton, Mass., has voted to appropriate money for an electric-light plant.

The town of Athol, Mass., contemplates installing a system of water meters.

The sawmill of C. G. Hume, Fairfield, Me., was destroyed by fire. Loss, $75,000.

Malden, Mass., has issued $12,000 bonds for improvements to its water system.

The large canning factory of Thorndike & Hix, Union, Me., was destroyed by fire.

The Fisk Rubber Company, Chicopee Falls, Mass., is erecting a new addition to its plant.

The bakery of O. W. Patterson, Cambridge, Mass., was destroyed by fire. Loss, $10,000.

Leominster, Mass., will purchase a new boiler for its stone crusher in the near future.

The Hill & Loper Company, Danbury, Conn., will build an addition to its hat-making plant.

Samuel F. Scott, Uxbridge, Mass., is to equip a new dyehouse with most modern machinery.

Jones Brothers Company, Barre, Vt., is to add two large additions to its granite-manufacturing plant.

The Thames River Specialty Company contemplates erecting a $500,000 cotton mill at Monteville, Conn.

The Harols, Inc., Waterbury, Conn., has incorporated with $5000 capital to conduct a dyeing establishment.

The Phœnix Carpet Company, Phœnixville, Conn., is to remove its plant to the Hammond factory in Putnam, Conn.

The Bridgeport (Conn.) Hydraulic Company is to expend $1,000,000 for the enlargement of the water system.

The Haverhill Electric Company, Haverhill, Mass., will add some new boilers; also erect a new stack next spring.

The large hay and grain plant of the H. K. Webster Company, Lawrence, Mass., was almost entirely destroyed by fire. Loss, $10,000.

E. G. Carleton & Son, manufacturers of silk warp white flannels, Rochdale, Conn., are to build a two-story addition to their plant.

The Field Lumbert Company, shoe manufacturer, Iowell, Mass., contemplates enlarging its plant and installing new machinery.

The Hamilton Woolen Company, Southbridge, Mass., is to erect a five-story addition to its finishing room. New equipment will be needed.

The plant of the Frost Finishing Company, West Barrington, R. I., controlled by the

O'Bannon Corporation, is to be enlarged for producing bookbinding.

Plans are being drawn to rebuild the plant of the Friedrichs Dyeing Company, Woonsocket, R. I., which was recently destroyed by fire at a loss of $50,000.

Frank H. Pfeiffer & Co., Natick, Mass., recently organized to manufacture shoes, has purchased the old carriage factory on North avenue, and will equip same.

The Frank E. Sessions Company, Worcester, Mass., casket manufacturer, has purchased land adjacent to its plant on Eaton place, and will erect a six-story addition.

The Standard Textile Company, recently incorporated for $100,000, is to locate a plant at Providence, R. I., for manufacturing and dyeing of silk, cotton and woolen yarns.

Dibble & Warner, Easthampton, Mass., manufacturers of belts and suspenders, have secured factory quarters on Worthington street, Springfield, Mass., and will move their plant there.

The Henry J. Perkins Company, Springfield, Mass., wholesale fruit and produce dealer, has purchased a tract of land on Dwight street, where a modern cold-storage plant will be erected.

Puritan Laundry Company, Inc., of New Haven, Conn., has been incorporated to conduct laundry, etc. Capital, $5000. Incorporators, David W. Johnston, Lillian B. Gilbert and Mary E. Gilbert.

MIDDLE STATES

Albion, N. Y., is considering a municipal water-supply system.

The Cleveland (Ohio) Dye Company has let a contract for a boiler house.

The J. P. Macbeth Iron Company, Cleveland, Ohio, will build a dry kiln.

The Cleveland (Ohio) Dye Works will install a new power plant for its factory.

A. & E. Whitworth, Cleveland, Ohio, will erect and equip a modern printing plant.

The Toledo (Ohio) Fiber Package Company will erect a new factory on Albion street.

The Blackburn Varnish Company, Evanston, Ohio, will build an extension to its plant.

Worthington, Ohio, will build a new municipal waterworks system to cost $20,000.

Fire destroyed the plant of the Penn Planing Mill Company, Reading, Penn. Loss, $50,000.

The Beaver Dam (Wis.) Foundry Company will erect a core room. S. Seering, general manager.

The erection of a municipal electric-light plant is being considered by the town of Carmel, Ind.

Fire did $10,000 damage to the canning factory of the Valvoline Oil Works, Edgewater, N. J.

The Keuosha (Wis.) Laundry Company will install a new boiler and probably a new small engine.

T. E. Purdy's lumber mills, at Altona, Clinton county, N. Y., were burned. Loss, about $25,000.

The C. S. Ball Manufacturing Company, of Dayton, Ohio, candy manufacturer, will enlarge its plant.

A 700-horsepower boiler belonging to Scott Brothers, canal contractors, near Auburn, N. Y., exploded.

The Edison Illuminating Company, of Detroit, Mich., will erect an addition to its downtown plant.

Plans are being prepared for the H. C. Wood Company, of Norwood, Ohio, for a $50,000 ice plant to be erected at Wyoming, Ohio.

Church & Hollis Company will build a $50,000 laundry at 1411-21 West Harrison street, Chicago, Ill., and install new machinery.

At Cincinnati, Ohio, the plant of the Pittsburg Plate Glass Company, which was recently damaged by fire, will be thoroughly repaired.

The Cincinnati Veneer Company will build several extensions to its plant on Sixth street, Cincinnati, Ohio. Louis Dittoe, architect, Cincinnati.

The Hollenden Hotel Company, Cleveland, Ohio, will partly rebuild and will need power machinery. Mr. Hammond is the architect in charge.

Power-plant equipment will be required for the 200-room hotel to be erected for the Erie (Penn.) Hotel Company. Cost, estimated at $600,000.

The Dayton (Ohio) Ice Cream and Dairy Company, capitalized at $100,000, will build a plant to cost $50,000. New equipment will be required.

The Ceronna Paper Company, of Akron, Ohio, has been incorporated to manufacture book-covering material. A. D. Wampler, principal stockholder.

Plans are being prepared for a large plant for the G. Edwin Smith Shoe Company, on Water street, Columbus, Ohio. New machinery will be installed.

The Franklin (Ind.) Color Works has been incorporated with $20,000 capital to manufacture paints and colors by R. J. Massop, Wm. Feathergill, Lowell, Mass.

The Van Wert Broom Company, Van Wert, Ohio, has been incorporated to manufacture brooms by C. N. Drury, C. J. Meyer, O. M. Fraylick, etc. Capital, $10,000.

The plant of the Fairmount Woolen Mills, owned by the Adler Underwear and Hosiery Company, Cincinnati, Ohio, will be enlarged, increasing its capacity one-fourth.

Kahn Brothers, smelters, 525 East Nineteenth street, New York, will locate in Brooklyn, where they have bought property at Meserole avenue and Humboldt street.

The B. L. & R. Printing Company, of Cleveland, Ohio, has been incorporated to do a general printing and publishing business and will need equipment. R. A. Barnch, T. A. Louis, I. N. Loeser, stockholders.

The Industrial Promotion Company, of Cleveland, Ohio, has been incorporated to manufacture paints and wood finishes and will need necessary equipment. R. F. Blakeslee, J. J. Shipley, E. T. Quick, stockholders.

The Toledo, Ann Arbor & Jackson Railroad Company has been incorporated and will build an electric line from Toledo, Ohio, to Jackson, Mich. L. E. Ingalls, president; R. E. Hamblin, vice-president; G. E. Fisher, secretary and treasurer.

SOUTHERN STATES

Fire destroyed the spoke factory of John W. Little, Paducah, Ky. Loss, $15,000.

Stehli & Co., High Point, N. C., silk manufacturers, will erect an additional mill.

Plans are being drawn for a large cigar-factory building to be erected for Elliott, Ottenheimer & Elliott, Baltimore, Md.

The broom factory of J. W. Myers & Co., Hagerstown, Md., was partly wrecked by flames. New machinery will be required.

The sash, door and blind factory of J. J. Hecker, at Tchoupitoulas and Arabella streets, New Orleans, La., was destroyed by fire. Loss, $60,000.

A five-story factory for the manufacture of corn starch and baking powders will be erected for Tiberius G. Pritchard, of Baltimore, Md., at 108 Grant street.

Fire destroyed the main plant of the Baltimore Broom Works, at Duncan street and Canton avenue, Baltimore, Md. The factory will be rebuilt and equipped with the latest machinery.

WEST OF THE MISSISSIPPI

An explosion at the Holland mine, Biwabik, Minn., wrecked the boiler and engine house.

The Manhattan (Nev.) Big Four Mining Company will install new pumping machinery.

Kelly & Sorenson's furniture plant at Clinton, Iowa, was destroyed by fire. Loss, $100,000.

The city of Phœnix, Ore., has voted bonds for the installation of a municipal waterworks system.

The city of San Mateo, Cal., will build a new pumping plant, in connection with its waterworks system.

The Stayton (Ore.) Chair Manufacturing Company will install new machinery at its woodworking plant.

The Northwestern Knitting Company will erect a $35,000 addition to its power house at Minneapolis, Minn.

The Diamond Creamery Company will erect a new creamery building at 1000-04 Western avenue, Minneapolis, Minn.

The Cœur d'Alene (Ida.) Lumber Company will build an addition to its plant and make other improvements. The capacity will be increased.

The Koken Barber Supply Company, St. Louis, Mo., will erect a six-story factory on Texas avenue and Sidney street to cost about $200,000.

The county court, Lebanon, Ore., plans for the erection of a rock-crushing plant near Lebanon. Property has been acquired for the plant.

The planing mill of the United Engineering Works, Oakland, Cal., was destroyed by fire, with a loss of $10,000. The plant will be rebuilt.

The lumber-working plant of the Hawkinson shingle mill, Snohomish, Wash., was destroyed by fire. It is said the plant will be rebuilt.

N. G. Blagen, Hoquiam, Wash., plans for the erection of a large woodworking plant for the manufacture of doors, sashes and kindred specialties.

The fruit-packing plant of the California Fruit Producers Company, Butte City, Cal., was destroyed by fire, with a loss estimated at $10,000.

The A. & W. Shingle Company, Tacoma, Wash., will build a shingle mill on South Fifty-eighth street. Modern machinery will be installed.

The Pacific Power and Light Company, Portland, Ore., will install an electric power system in the Ringold Bar district, near Ringold, Wash.

The printing plant of George Rice & Sons, Los Angeles, Cal., was partially destroyed by fire to the extent of $10,000 loss. The plant will be replaced.

L. Campbell, Wastucna, Wash., plans for the erection of a flour-milling plant. The plant will be electrically operated, and an electric power plant for this purpose installed.

The Mountain States Telephone and Telegraph Company, Denver, Colo., will erect a new exchange plant on Griggs street, Las Cruces, N. M. About $60,000 will be expended.

The Great Western Power Company, Tucson, Ariz., plans for the erection of a large electric power plant in the Sabino cañon, near Tucson. The work is estimated to cost $1,000,000.

The Yamhill Electric Company, Newberg, Ore., plans for the installation of an electric-light and power system in Newberg and neighboring sections of Yamhill county. A franchise has been granted.

The plant of the Standard Carbon Company, Stanford street, Los Angeles, Cal., manufacturer of carbon and wax products, was destroyed by fire. The plant will be rebuilt and new equipment installed.

The Federal Power and Water Company, Tucson, Ariz., plans for the erection of a large electric power plant at the junction of Sabino and Bear creeks, near Tucson. H. W. Roche is president of this company.

The city of Winnemucca, Nev., plans for the installation of a waterworks plant and electric-lighting system. Burns & McDonnell, hydraulic engineers, Kansas City, have been engaged to prepare plans and estimates.

The Big Blue Mining Company, Wickenburg, Ariz., plans for the erection of an electric power plant on the Hassayampa river, with a distributing system throughout the district. Robert H. Browne is in charge.

Libby, McNeil & Libby, Chicago, Ill., fruit and meat packers, plan for the erection of a fruit-canning plant at Oroville, Cal. A vegetable and olive-packing plant will be established in connection. The plant will be fully equipped.

Isabelle Garwood, Yuba City, Cal., has acquired property near Nicolaus, and plans for the erection of a large creamery, dairy and cheese-manufacturing plant. The plant will be fully equipped. S. N. Seawall is in charge of this work.

The Chemolith Manufacturing Company, Los Angeles, Cal., has leased property on South Hill street, and will establish a plant for the manufacture of patented drain boards and floors for house use. Modern equipment will be installed.

The Western Lead Paint Company, Spokane, Wash., formerly the Kingsley Chemical Reduction Company, is building a modern paint-manufacturing plant. The plant will be fully equipped. S. A. Anderson is president and manager.

G. I. Toevs, Lindsborg, Kan., president of the Lindsborg Milling and Elevator Company, contemplates the erection of a large flour milling and elevator plant at Spokane, Wash. The plant will be fully equipped and is estimated to cost $100,000.

The Mt. Whitney Power Company, Porterville, Cal., plans to rebuild and improve its entire power system. New equipment will be installed throughout. The company also contemplates the installation of an electric-lighting system at Lindsay, Cal.

The Imperial Valley Telephone Company, El Centro, Cal., plans for the construction of a system from El Centro to Seeley, on New river, by way of Imperial and Dixie. Stations will be established along the route. J. F. Bezdecheck is general manager.

The San Diego (Cal.) Times Publishing Company, Front street, recently incorporated, will establish a modern printing plant for issuing a daily paper. The plant will be fully equipped. Gresner Williams and Harry Gray are at the head of the company.

Power-plant and electrical equipment will be installed in the new theater building to be erected at Oakland, Cal., by Kahn & Co., of New York City. The structure is estimated to cost $800,000. B. M. Priteca, architect, San Francisco, Cal., is preparing plans.

The Fuller Submarine Torpedo Boat Company of California, has been incorporated at San Francisco, Cal., by John E. and E. J. Bennett, of Palo Alto, Cal., and W. M. Smith and N. M. Twomey, of San Francisco, with a capital of $5,000,000. The company will establish headquarters at San Francisco, and plans for the erection of a boat-building plant.

CANADA

Upton, Que., will equip complete new waterworks.

Brampton, Ont., will equip a new hydro-electric plant.

Rockwood, Ont., will equip a new hydro-electric station.

Pointe Claire, Que., will equip a new electric-lighting plant.

Upton, Que., will equip a complete new electric-lighting plant.

Pointe Claire, Que., will equip a new waterworks pumping plant.

The Rock City Tobacco Company will build a big new factory at Quebec.

The Sunset Power Company will equip a new plant at Kamloops, B. C.

The Bronson Mills Company, of Ottawa, will build a large new pulp mill.

The Carson creamery, at Winnipeg, Man., will install a $250,000 creamery plant.

S. A. Rife & Co. will equip a new factory at Walkerton for manufacturing woolens.

The Mount Forest Carriage Company, of Mount Forest, Ont., will extend its plant.

The Seymour Power and Electric Company will equip a new substation at Napanee, Ont.

The Lake of the Woods Milling Company's barrel factory, at Keewatin, Ont., was burned.

Fire destroyed $10,000 worth of machinery in the mill of Arthur Benoit, at St. Barnabe, Que. New saws, planers, etc., will be bought.

The Brantford Cold Storage Company will equip a complete new plant at Brantford, Ont. Motors, fans, elevators, etc., will be purchased.

The Lake Megantic Pulp Company will buy turbine engines for a big new power plant to be built on the Chaudiere river, at Lake Megantic, Quebec.

BUSINESS ITEMS

Laughlin-Barney Machinery Company, Union Bank building, Pittsburg, Penn., has been incorporated to act as machinery selling agents.

The Cincinati Lathe and Tool Company, Cincinnati, Ohio, is now located in its new quarters at Oakley, where greatly increased manufacturing facilities are available.

The Hoskins Manufacturing Company, Detroit, Mich., has purchased the business of the International Electric Meter Company, of Chicago, maker of ammeters and voltmeters.

The Triumph Electric Company, Cincinnati, Ohio, has recently opened a district office at 2219 Farmers' Bank building, Pittsburg, Penn. D. D. Gill will be in charge of the new office.

Pratt & Cady Company, Hartford, Conn., will, in the future, market its own product. It has severed relations with the Fairbanks Company, who has been its exclusive agent for 28 years.

D. Drury & Co., engineers and machine-tool importers, Central house, Johannesburg, South Africa, are desirous of securing sole agencies for South Africa of American machine tools and engineering specialties.

All the machinery, consisting of Hendey lathes, Davis lathes, Foster turret lathes, Brown & Sharpe millers, gear cutters and universal grinders and other tools forming the equipment of the Mora Automobile Company, of Newark, N. Y., has been purchased by Frank Toomey, Inc., of Philadelphia, Penn.

On December 1, 1911, the Reading Steel Casting Company, with works at Reading, Penn., and the Bayonne Castings Company, with works at Bayonne, N. J., will be consolidated under the name of the Reading-Bayonne Steel Casting Company. The officers of the new company will be William D. Sargent, chairman of board of directors; J. Turner Moore, president; A. E. Williamson, vice-president, and D. W. Yeckley, secretary and treasurer.

FORTHCOMING MEETINGS

American Society of Mechanical Engineers, annual meeting, December 5 to 8, New York City. Calvin W. Rice, secretary, Engineering Societies building.

Society of Automobile Engineers, annual convention, New York City, January 18-20, 1912. C. F. Clarkson, general manager, 1451 Broadway, New York City.

American Society of Engineer Draftsmen, regular meeting third Thursday of each month H. F. Sloan, secretary, 116 Nassau street, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Hotel Bellevue. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North,

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Calipers: Welles Caliper Co., Milwaukee, Wis.

Sachs' standardized tool requisitions; mechanical drawings. J. J. Sachs, Lynchburg, Va.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Machinery built to order; modern plant; 30 miles from New York. Box 335, AMER. MACHINIST.

Wanted—Screw machine work; send blueprints or samples for quotations. Remington Mfg. Co., Fitchburg, Mass.

We build to order light machinery, tools, jigs, subpresses and dies; high-grade work. The Elgin Tool Works, Elgin, Ill.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—Second-hand six to 10 spindle, about 20-inch circle multiple drilling machine, 1 inch drill capacity. Box 634, AM. M.

Tool tempering chart, printed in colors with full description; 13½x9½ inches; 10 cents postpaid. Spon & Chamberlain, 123 Liberty St., New York.

Wanted—High grade machine work in quantities for gear cutters, hand turrets, milling machines, etc. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Small shop holding valuable automatic machine tool patents, desires machinery agency to finance expansion necessary for manufacture and sale of same. Box 620, AM. MACH.

I procure patents of highest professional skill; moderate rates; convenient payments arranged; personal attention throughout; information offered gratis. Benjamin Roman, Park Row building, New York.

Simple, meritorious inventions bring profits, often fortunes; mail description of your invention for free, candid opinion and estimate to apply for patent. E. P. Thompson, M. E., Victor Bldg., Washington, D. C.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

A strong, old established manufacturing company, with a national selling organization, wants to add a new line of building material or construction specialty to manufacture and sell. Address "X," Box 617, AM..M.

Technical patents are best taken care of by an engineering patent attorney, with sound practical experience, both as an engineer and as an attorney; highest references. G. M. Sacerdote, M. E., and Reg'd Patent Attorney, 1919 Broadway, New York City.

A valuable system of patented piston rings, for pumps, compressors, oil, gasolene and steam engines, maximum compression, long life, 40 per cent. saving in manufacture. Information obtainable by addressing Lewis R. Compton & Co., 50 Church St., New York City.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Company, Inc., 40 West 13th St., New York City.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Superintendent for machine screw shop in Canada, man with selling ability; state experience and salary expected. Box 615, AMERICAN MACHINIST.

ILLINOIS

Nonunion foreman or superintendent for machine shop, working in conjunction with foundry, in city of 25,000; must be progressive, good organizer of shop force and experienced in details of machine shop practice; open shop; write fully, giving experience, age and salary expected. Box 623, AM. MACH.

INDIANA

Wanted—Electrical instrument maker for experimental work, steady position. Remy Electric Co., Anderson, Ind.

MICHIGAN

Wanted—Toolmakers and metal pattern makers, medium size work; state wages, age, married and experience. Box 625, AM. MA.

NEW JERSEY

Mechanical draftsman, experienced in tool design and one tracer. Apply Rushmore Dynamo Works, Plainfield, N. J.

Metallurgist, by a company located vicinity New York City; must understand thoroughly analysis of iron and steel; also heat treatment of same, and physical testing work; exceptional opportunity for capable party. Box 622, AMERICAN MACHINIST.

Draftsmen—Competent men with broad experience in mill-building construction, power plant design and general engineering, wanted at once by large industrial plant near New York City; full particulars as to experience, age, salary and references required. Box 596, AMERICAN MACHINIST.

Wanted—A young man that has been trained in the manufacture and installation of air-moving machinery, disc fans and ventilating work, to work into a permanent position in an old established fan and ventilating business as assistant superintendent; must be well recommended and an all-round mechanic, capable of taking full charge of a small shop where a great variety of work is done. Address J. M. Seymour, Jr., 51-53 Lawrence Street, Newark, N. J.

NEW YORK

Wanted—Experienced foreman for scale beam room in large scale factory; high wages to the right man. Box 595, AMER. MACH.

Wanted—Chief draftsman acquainted with crane and hoist construction; one who can give positive evidence of ability, can secure permanent and satisfactory position. Address Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

OHIO

Wanted—Designer and draftsman who is thoroughly familiar with presses, shears and special machinery. Box 561, AMER. MACH.

Draftsman, experienced man on punching and shearing machinery; state age, experience, references, salary, etc. Box 629, AM. M.

Wanted—Machine shop foreman; medium and heavy work; seventy-five to one hundred men; must have good judgment, be acquainted with best modern shop practice, and be able to reduce costs; state age, references and salary; permanent. Box 597, AM. MACH.

Detail draftsman, a good testing and outside man for installation; several good traction engine erectors for gas engine work; we are also contemplating establishing a planning department and would like to get in touch with some one capable of planning all the work throughout the factory; also establishing time limits. Box 616, AMER. MACH.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Sheet Metal—First class man on auto bodies; state experience and salary expected. Box 618, AMERICAN MACHINIST.

Wanted—Tool steel salesman; must thoroughly understand selling and demonstrating steel; unusual opening for A-1 man; knowledge of Middle States territory preferred. Box 621, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

ILLINOIS

Punch and die designer, experienced on typewriter and adding machine work, wants responsible position, shop or drafting room. Box 609, AMERICAN MACHINIST.

INDIANA

Tool designer with a broad experience on special machinery and equipment for manufacturing to best advantage. Box 631, AM. M.

Manager wants position; ten years' experience in sheet metal stamping business; good executive and finished correspondent; cost and production expert; thoroughly familiar with modern office and shop methods, labor problems, etc.; thirty-five years of age and married; capable, steady and a hustler. Box 590, AMERICAN MACHINIST.

MASSACHUSETTS

Toolmaker, 38, fifteen years' experience, jig, fixture, gage, experimental, on close accurate work; now assistant foreman; would like position with chance of advancement. Box 632, AMERICAN MACHINIST.

Designer of automatic machinery, jigs, fixtures, dies, etc.; practical mechanic, good executive with broad experience, desires responsible position; salary, $200 monthly. Box 624, AMERICAN MACHINIST.

Designer, would like to communicate with a concern having open a permanent position for a first-class man with ten years' practical shop and office experience on jigs, fixtures and special machinery. Box 614, AMER. MACH.

Master mechanic, 36, expert on draw press dies, tool jig, experimental and machine construction work; also maintenance in large factories; practical man, seven years executive, desires position as master mechanic or tool room foreman; New England preferred. Box 619, AMERICAN MACHINIST.

MICHIGAN

Wanted—Position as general superintendent or works manager; applicant is 37 years old and has had a successful career building steam turbines, steam engines and automobiles; is an expert on systematizing and getting highest production with minimum labor cost; let me help you to bring that plant of yours up to its maximum efficiency. Address I. E. Hindman, 152 Englewood Ave., Detroit, Michigan.

NEW JERSEY

Mechanical engineer, expert machine designer, desires position. Box 628, AM. MACH.

Foreman, American, desires change; has general experience, including shop tools, etc.; 12 years as executive; East preferred. Box 630, AMERICAN MACHINIST.

Shop foreman, six years' factory experience in gas tips and electric novelty manufacturing, wishes steady position with opportunity for advancement; age 26; A-1 reference. Box 626, AMERICAN MACHINIST.

NEW YORK

Experienced designer of Diesel oil engines desires position. Box 557, AMER. MACH.

Mechanical draftsman, with various experience, wishes position. Box 607, AM. MACH.

Factory appraisal my specialty, ten years; finish this job November 20. Box 555, AM. M.

Draftsman, ten years' wide experience, designing special and automatic machinery; original, fast and accurate. Box 635, AM. M.

Tool and die maker, first class, good tool designer, wishes position as assistant foreman in New York; good reference. Box 639, AMERICAN MACHINIST.

Draftsman, wide practical executive experience with reliable concern, capable of originating special machinery, etc. Box 638, AMERICAN MACHINIST.

Tool and die maker, familiar with all kinds of dies, can design tools for manufacturing duplicate parts; first-class references. Box 613, AMERICAN MACHINIST.

Chief draftsman, expert practical designer of special machinery, tools and dies, wishes responsible and executive position where originality and experience in modern shop and office methods are required. Box 633, AMERICAN MACHINIST.

Die casting superintendent desires change; 15 years' experience, all branches; exceptional executive ability; energetic, progressive, systematic, resourceful, reliable, expert, alloys, dies, casting machines, marked sales ability. Box 640, AMERICAN MACHINIST.

Machinist, inventor, 14 years' practical machine shop experience, expert on experimental work, good draftsman and practical designer on special automatic machinery and tools, wishes position where man with new mechanical ideas is required; able to take charge. Box 641, AMERICAN MACHINIST.

OHIO

Master mechanic or superintendent requires position with a concern requiring a first-class man that can produce results along the line of metal stamping of all kinds; I am a first-class man, a careful organizer with good executive ability; a thorough expert on designing the most uptodate dies and fixtures for rapid manufacturing; excellent references. Box "J.," AMERICAN MACHINIST.

PENNSYLVANIA

Experienced tool and machine designer wants position near New York. Box 483, AMERICAN MACHINIST.

Young man with technical education desires position as salesman or manager with machinery manufacturing concern; has had previous experience in both of above lines of work. Box 642, AMERICAN MACHINIST.

RHODE ISLAND

Competent mechanical engineer, graduate, five years' experience, open for engagement January 1; good systematizer; able executive and superintendent. Box 577, AM. MACH.

WISCONSIN

Successful foreman desires position as foreman of tool, die or model room; experienced on automobile and sheet metal tools, dies and interchangeable parts; employed at present. Box 627, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

We have been asked what good came of the convention of advertising men in Boston.

Of course, there were many tunes played, but the note that was heard above all others was honesty.

Honest, straightforward advertising has the right of way.

Over 2000 business men—buyers and sellers—from all over this continent and England, so declared themselves.

They demanded that everyone who wants the respect of other sellers, who wants the business of the buying public, must play fair.

That's the handwriting on the wall.

Selling practices that have heretofore been passed over in silence, if not condoned, must stop.

The fraudulent, lying advertiser is an outlaw and will be so looked on.

The crook will find his doom under the steam roller of progress.

One speaker said:

"For two years and more we have steadfastly held to a purpose. That purpose is to educate the advertisers of this country that there is but one kind of advertising that will be permanently profitable and that is honest, truthful advertising. And at the same time we are endeavoring to teach the American people the believableness of advertising and forever stamp out the stigma of untruth, which is so often applied to advertising, and banish from the minds of the people the thought that an advertisement of a corporation or firm is in any degree less reliable than its signed statement."

Another result is a movement on foot to have a national law for the repression of dishonest advertising.

Mayor Gaynor, of New York, on November 10, wrote to the editor of *Printer's Ink* referring to this:

"I have read the proposed statute which you inclose to me and I can see no reason why it should not be adopted. To publish false and misleading statements in advertisements ought to be a criminal offense. Of course the business of advertising is now reduced almost to a science and the great majority of advertisements are truthful."

That's the kind of advertising in these columns. No false statements can appear if we know it.

* * *

Only reliable products can be continuously advertised.

ALPHABETICAL INDEX TO ADVERTISERS

PAGE

Abbott Ball Co. 113
Acme Machine Tool Co. 30
Acme Machinery Co. 127
Adams Co. 104
Adt & Son, John 126
Allen Mfg. Co., The 128
Almond Mfg. Co., T. R. 94
American Emery Wheel Wks. 120
American Gas Furnace Co. 108
American Machinist 129
American Pulley Co. 91
American Tap & Die Co. 99
American Tool Works Co. 8
American Tool & Machine Co. 124
American Vanadium Co. 107
Ames Co., B. C. 86
Armstrong-Blum Mfg. Co. 93
Armstrong Bros. Tool Co. 84
Athol Machine Co. 128
Atkinson Co., The 110
Auburn Ball Bearing Co. 90
Automatic Machine Co. 61

Baird Machine Co. 121
Baker Bros. 129
Barber-Colman Co. 37
Barnes Co., W. F. & John 33
Barnes Co., Wallace 128
Barnes Drill Co., Inc. 98
Barnett Co., G. & H. 50
Bath Grinder Co. 65
Baush Machine Tool Co. 36
Bay State Stamping Co. 89
Bay State Tap & Die Co. 100
Beaman & Smith Co. 25, 94
Becker Milling Machine Co. ... 23
Bemis & Call Hardware and Tool Co. 92
Besly & Co., Chas. H. 85
Betts Machine Co. 9
Bignall & Keeler Mfg. Co. 127
Bilgram Machine Works 105
Billings & Spencer Co. 92
Blake & Johnson Co. 120
Blanchard Machine Co. 76, 101
Bliss Co., E. W. 59
Blount Co., J. G. 119
Boker & Co., Hermann 77
Boston Gear Works 102
Bradford Machine Tool Co. ... 5
Bristol Co. 136
Brown Co., A. & F. 104
Brown & Co., R. H. 96
Brown & Sharpe Mfg. Co. .55, 136
Brown Hoisting Machry. Co. .. 90
Brown Instrument Co. 101
Brubaker & Bros., W. I. 99
Bryant Chucking Grinder Co. 25
Bullard Machine Tool Co. .70, 71
Burke Electric Co. 124
Butterfield & Co. 100

Calculagraph Co. 101
Caldwell Co., Inc., W. E. 90
Caldwell & Son Co., H. W. 128
Carborundum Co. 42
Card Mfg. Co., S. W. 40, 41
Carpenter Tap & Die Co., J. M. 100
Carter & Hakes Machine Co. .. 105
Celfor Tool Co. 98
Champion Tool Works Co. 86
Chicago Flexible Shaft Co. 107
Chicago Pneumatic Tool Co. .. 116
Chicago Rawhide Mfg. Co. 104
Cincinnati Bickford Tool Co. 10, 11
Cincinnati Gear Co. 102
Cincinnati Gear Cutting Machine Co. 48
Cincinnati Lathe & Tool Co. .. 88
Cincinnati Milling Mach. Co. .6, 7
Cincinnati Planer Co. 16
Cincinnati Shaper Co. 48
Clayton Air Compressor Wks. 117
Cleveland Auto. Mach. Co. 18
Cleveland Planer Works. 81
Cleveland Twist Drill Co. 136
Clough, R. M. 99
Coates Clipper Mfg. Co. 129
Coes Wrench Co. 32
Colburn Machine Tool Co. 81
Colonial Leather Co. 102
Columbus Die Tool & Mach. Co. 99
Cook Co., Asa S. 127
Covington Machine Co. 126
Cowdrey Machine Works, C. H. 127
Crucible Steel Co. of America. 109
Curtis & Curtis Co. 127
Cushman Chuck Co. 95

Dallett Co., Thos. H. 117
Dart Mfg. Co., E. M. 109
Davenport Machine Tool Co. .. 128

PAGE

Delaware Hard Fibre Co., Ltd. 91
Dessau's Sons, S. 119
Detrick & Harvey Mach. Co. ... 73
Detroit Twist Drill Co. 97
Diamond Chain & Mfg. Co. ... 90
Diamond Machine Co. 120
Dickinson, Thos. L. 50
Dill Slotter People 115
Dixon Crucible Co., Jos. 112
Doehler Die Casting Co. 107
Dreses Machine Tool Co. 22
Durbrow & Hearne Mfg. Co. ... 101

Earle Gear & Mach. Co. 104
Electric Controller & Mfg. Co. 125
Electric Welding Products Co., 110
Elmes Engineering Works, Chas. F. 121
Errington, F. A. 95
Evans Friction Cone Co. 90
Excelsior Needle Co. 127

Fawcus Machine Co. 102
Fellows Gear Shaper Co. 24
Ferracute Machine Co. 121
Firth-Sterling Steel Co. 106
Fitchburg Machine Works ... 35
Flather & Co., Inc. 87
Flather Mfg. Co., E. J. 105
Foote Bros. Gear & Mach. Co. 104
Foote-Burt Co. 99
Fosdick Machine Tool Co. 32
Foster Co., Walter H. 89
Franklin Mfg. Co. 110
Frontier Iron Works 99

Gang Co., W. E. 98
Gardner Machine Co. 118
Garvin Machine Co. 75, 94
Gem Mfg. Co. 119
General Electric Co. 122
Geometric Tool Co. 42
Gilbert & Barker Mfg. Co. 109
Gisholt Machine Co. 86
Glidden Varnish Co. 108
Goodyear, Inc., Nelson 111
Gorton Machine Co., Geo. 112
Gould & Eberhardt 31
Graham Mfg. Co. 105
Grant Gear Works 102
Grant Mfg. & Mach. Co. 124
Gray Co., G. A. 28
Greaves, Klusman & Co. 86
Greene, Tweed & Co. 96
Greenfield Machine Co. 120
Grönkvist Drill Chuck Co. 96

Hammacher, Schlemmer & Co. 65
Harrington, Son & Co., Edw. . 91
Hart & Cooley Co. 75
Hawkridge Bros. Co. 112
Heald Machine Co. 34
Hemming Bros. Co. 126
Hendey Machine Co. 61
Henry & Wright Mfg. Co. 43
Hess-Bright Mfg. Co. 78
Hilles & Jones Co. 126
Hoefer Mfg. Co. 69
Hoggson & Pettis Mfg. Co. 95
Holroyd & Co. 99
Holtzer-Cabot Electric Co. 124
Horsburgh & Scott Co. 105
Horton & Son Co., E. 94
Horton Machine Co., S. E. 94
Hoskins Mfg. Co. 115
Hurlbut-Rogers Machine Co. ... 128
Hyatt Roller Bearing Co. 92

Independent Pneu. Tool Co. ... 117
Ingersoll Milling Mach. Co. 4
Ingersoll-Rand Co. 117
International Oxygen Co. 112

Jessop & Sons, Inc., Wm. 109
Johnson Machine Co., Carlyle. 83
Johnson, Jr., Co., Inc., L. H. . 89
Jones & Lamson Mach. Co., 12, 13, 50

Kearney & Trecker Co. 26
Kelly Co., R. A. 88
Kempsmith Mfg. Co. 27
Kinkead Mfg. Co. 84

La Salle Mach. & Tool Co. 118
Laidlaw-Dunn-Gordon Co. 116
Landis Machine Co. 100
Landis Tool Co. 57
Lapointe Co., J. N. 110

PAGE

Lapointe Machine Tool Co. ... 82
LeBlond Mach. Tool Co., R. K., 63, 136
Leland & Co., W. H. 98
Lincoln-Williams Twist Drill Co. 99
Link-Belt Co. 1, 79
Lodge & Shipley Machine Tool Co. 14, 15
Long & Allstatter Co. 126
Lucas Machine Tool Co. 115
Lumen Bearing Co. 111

Machinery Forging Co. 111
Mack Mfg. Co., Carl 114
Manning, Maxwell & Moore .. 129
Manufacturing Equipment and Engineering Co. 101
Maris Bros. 90
Marshall & Huschart Mch. Co. 131
Marvin & Casler Co. 96
Massachusetts Saw Works 93
McCabe, J. J. 89, 130
Meisel Press & Mfg. Co. 102
Meisselbach-Catucci Mfg. Co. . 104
Merritt, Jos. 50
Millers Falls Co. 93
Milton Mfg. Co. 67
Milwaukee Machine Tool Co. . 86
Mitts & Merrill 114
Modern Tool Co. 118
Moore Co., Franklin 92
Morris Machine Tool Co., J. B. 112
Morrow Mfg. Co. 95
Morse Chain Co. 91
Morse Twist Drill and Mach. Co. 59
Morton Mfg. Co. 96
Motch & Merryweather Machinery Co. 130
Mueller Machine Tool Co. 98

Nast Machinery Co., D. 131
National-Acme Mfg. Co. 134
National Brake & Electric Co. 119
National Machine Co. 99
National Machinery Co. 126
National Tube Co. 111
Nazel Engr. & Machine Wks. . 121
New Britain Machine Co. 84
New Haven Mfg. Co. 87
New Process Raw Hide Co. 103
Newark Gear Cutting Machine Co. 104
Newton Machine Tool Wks. ... 19
Niagara Machine & Tool Wks. 121
Nicholson & Co., W. H. 75
Nicholson File Co. 17
Niles-Bement-Pond Co. ... 2, 3, 46
Northern Engineering Wks. 90
Norton Co. 69
Norton Grinding Co. 68
Nuttall Co., R. D. 102

Oneida Steel Pulley Co. 91
Osgood, J. L. 92
Otto Gas Engine Co. 105

Page-Storms Drop Forge Co. . 114
Pangborn Co., Thomas W. 117
Parker Co., Chas. 105
Paxson Co., J. W. 117
Philadelphia Gear Works. 102
Poole Engineering & Mach. Co. 104
Potter & Johnston 20, 21
Pratt & Whitney Co. 47
Pratt Chuck Co. 94
Precision Die-Casting Co. 112
Prentice Bros. Co. 29
Prentiss Tool & Supply Co. ... 130

Ransom Mfg. Co. 118
Recording Register & Fare Box Co. 101
Reed Co., F. E. 44
Reed Mfg. Co. 105
Reliance Electric & Engineering Co. 124
Revolute Machine Works. 92
Richmond Electric Co. 124
Rivett Lathe Mfg. Co. 135
Rochester Boring Machine Co. 124
Rockford Drilling Mach. Co. . 132
Rockwood Mfg. Co. 90
Rogers & Hubbard Co. 109
Root Co., C. J. 101
Roth Bros. & Co. 124
Rowbottom Machine Co. 118
Rummel Machine Screw Co. ... 128

Safety Emery Wheel Co. 119

PAGE

S. K. F. Ball Bearing Co. 74
Saunders' Sons, D. 127
Sawyer Gear Works. 102
Schieren Co., Chas. A. 114
Schuchardt & Schütte. .17, 28, 96
Schumacher & Boye. 22
Sebastian Lathe Co. 88
Sellers & Co., Inc., Wm. 38
Seneca Falls Mfg. Co. 76
Shaw Electric Crane Co. 90
Shepard Electric Crane and Hoist Co. 92
Shore Instrument & Mfg. Co. . 113
Shuster Co., F. B. 126
Sibley Machine Tool Co. 80
Sigourney Tool Co. 97
Simonds Mfg. Co. 93
Simonds Mfg. Co., The 102
Simplex Mfg. Co. 93
Skinner Chuck Co. 96
Sloan & Chace Mfg. Co. 88
Slocomb Co., J. T. 98
Smart Mfg. Co., A. J. 100
Smith & Mills Co. 89
Smooth-On Mfg. Co. 111
Sprague Electric Works. 123
Springfield Machine Tool Co. . 49
St. Louis Sales Co. 105
Standard Engineering Wks. . 127
Standard Gauge Steel Co. 112
Standard Tool Co. 26
Standard Welding Co. 106
Stark Tool Co. 86
Starrett Co., L. S. 72
Sterling Emery Wheel Co. 119
Sullivan Machinery Co. 117

Tabor Mfg. Co. 113
Taft-Peirce Mfg. Co. 132
Tate, Jones & Co. 114
Taylor & Fenn Co. 97
Taylor-Wilson Mfg. Co. 104
Thompson & Son Co., Henry G. 93
Tindel-Morris Co. 93
Toledo Bridge & Crane Co. 90
Toledo Electric Welder Co. ... 111
Toledo Machine & Tool Co. ... 121
Toomey, Inc., Frank. 129, 134
Townsend Mfg. Co., H. P. 126
Treadwell Engineering Co. 127
Trimont Mfg. Co. 85
Triumph Electric Co. 123

Union Drawn Steel Co. 108
Union Mfg. Co. 95
Union Twist Drill Co. 67
United Engineering & Fdry. Co. 121
U. S. Electrical Tool Co. 100
United Steel Co. 108
Universal Boring Machine Co. 92
Universal Machine Screw Co. 127
Utica Drop Forge & Tool Co. . 84

Vanadium-Alloys Steel Co. 111
Vandyck Churchill Co. 93
Veeder Mfg. Co. 101
Vitrified Wheel Co. 118
Von Wyck Mach. Tool Co. 88
Vulcan Crucible Steel Co. 110

Walker & Co., O. S. 136
Waltham Machine Works. 86
Waltham Watch Tool Co. 101
Walworth Mfg. Co. 50
Ward & Sons, Edgar T. 113
Warner & Swasey Co. 39
Washburn Shops 118
Waterbury Farrel Fdry. and Machine Co. 50
Watson-Stillman Co. 77
Weeks, C. S. 105
Wells & Son, F. E. 119
Wells & Soulis. 124
Wells Bros. Co. 100
West Haven Mfg. Co. 93
Western Tool & Mfg. Co. 124
Westinghouse Elec. & Mfg. Co. 123
White & Bagley Co. 119
Whitlock Coil Pipe Co. 114
Whitman & Barnes Mfg. Co. .. 97
Whitney Mfg. Co. 53
Whiton Machine Co., D. E. ... 94
Wiley & Russell Mfg. Co. 100
Williams & Co., J. H. 80
Wilmarth & Morman Co. 120
Windsor Machine Co. 45
Woodward & Powell Planer Co. 115
Worcester Machine Screw Co. 127
Wormer Mchry. Co., C. C. 131

Yale & Towne Mfg. Co. 91

CLASSIFIED INDEX TO ARTICLES ADVERTISED

Abrasive Materials
American Emery Wheel Wks..120
Carborundum Co..... 42
Dessau's Sons, S.....119
Dickinson, Thos. L..... 50
Norton Co..... 69
Safety Emery Wheel Co.....119
Vitrified Wheel Co.....118

Accumulators, Hydraulic
Niles-Bement-Pond Co....2, 3, 46
Watson-Stillman Co..... 77

Air Lifts
Chicago Pneumatic Tool Co...116
Ingersoll-Rand Co.....117

Alundum
See Grinding Wheels.

Arbor Presses
Barnes Co., W. F. & John.... 33
Niles-Bement-Pond Co....2, 3, 46
Wilmarth & Morman Co.....120

Arbors
Brown & Sharpe Mfg. Co..55, 136
Cleveland Twist Drill Co....136
Detroit Twist Drill Co..... 97
Morse Twist Drill & Machine Co. 59
Pratt & Whitney Co..... 47
Pratt Chuck Co..... 94
Skinner Chuck Co..... 96
Union Mfg. Co..... 95
Union Twist Drill Co..... 67
Whitman & Barnes Mfg. Co.. 97
Whitney Mfg. Co..... 53
Wilmarth & Morman Co.....120

Babbitt Metals
Lumen Bearing Co.....111

Balls, Steel
Abbott Ball Co.....113
Auburn Ball Bearing Co..... 90
Boker & Co., Hermann..... 77

Barrels, Tumbling
Abbott Ball Co.....113
Baird Machine Co., The.....121

Bars, Boring
Beaman & Smith Co.....25, 94
Cleveland Twist Drill Co....136
Elmes Engineering Works, Chas. F.....121
Niles-Bement-Pond Co....2, 3, 46

Bearings, Ball and Roller
Auburn Ball Bearing Co..... 90
Boston Gear Works.....102
Hess-Bright Mfg. Co. 78
Hyatt Roller Bearing Co..... 92
S. K. F. Ball Bearing Co.... 74

Bearings, Bronze
Lumen Bearing Co.....111

Bearings, Die-Cast
Doehler Die Casting Co.....107
Franklin Mfg. Co.....110
Precision Die-Casting Co.....112

Belt Clamps
Billings & Spencer Co..... 92
Hoggson & Pettis Mfg. Co.... 95

Belt Dressing
Dixon Crucible Co., Joseph...112
Link-Belt Co. 1, 79
Schieren Co., Chas. A.....114
White & Bagley Co.....119

Belt Fasteners
Bristol Co.....136
Greene, Tweed & Co..... 96

Belt Filler
Schieren Co., Chas. A.....114

Belting, Leather
Chicago Rawhide Mfg. Co....104
Colonial Leather Co.....102
Schieren Co., Chas. A.....114

Benches, Work
Brown & Sharpe Mfg. Co..55, 136
Manufacturing Equipment and Engineering Co.....101
Western Tool & Mfg. Co.....124

Bending Machinery, Hydraulic
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38

Bending Machines, Plate
Long & Allstatter Co.....126
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Toledo Mach. & Tool Co.....121

Bending Machines, Power
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38

Blanks, Nuts and Screw
Electric Welding Products Co.110

Blocks, Chain
See Hoists, Hand

Blocks, Driving
Nicholson & Co., W. H..... 75

Blowers
American Gas Furnace Co....108
Chicago Flexible Shaft Co...107
General Electric Co.....122
Niles-Bement-Pond Co....2, 3, 46
Roth Bros. & Co.....124
Westinghouse Elec. & Mfg. Co.123

Blue Print Machines
Revolute Machine Co..... 92

Blue Print Paper
Revolute Machine Co..... 92

Bolt and Nut Machinery
Acme Mchry. Co.....127
Detrick & Harvey Mach. Co.. 73
Foote-Burt Co..... 99
Harrington, Son & Co., Edwin. 91
Landis Machine Co.....100
McCabe, J. J.....89, 130
Motch & Merryweather Machinery Co.....130
National-Acme Mfg. Co.....134
National Machinery Co.....126
New Haven Mfg. Co..... 87
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Sellers & Co., Wm..... 38
Standard Engineering Wks...127
Waterbury Farrel Fdry. and Mach. Co..... 50
Wiley & Russell Mfg. Co.....100

Bolts and Nuts
Electric Welding Products Co.110
National-Acme Mfg. Co.....134

Bone for Case-Hardening
Rogers & Hubbard Co.....109

Boosters
Burke Electric Co.....124
General Electric Co.....122
Westinghouse Elec. & Mfg. Co.123

Boring and Turning Mills, Vertical
American Tool Wks. Co..... 8
Baker Bros. 120
Betts Machine Co..... 9
Bullard Machine Tool Co..70, 71
Colburn Machine Tool Co.... 81
Flather Mfg. Co., E. J.....105
Gisholt Machine Co..... 86
Harrington, Son & Co., Edwin. 91
Manning, Maxwell & Moore...129
Marshall & Huschart Machinery Co. 131
McCabe, J. J.....89, 130
Mitts & Merrill.....114
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Wormer Mchry. Co., C. C....131

Boring, Drilling and Milling Machines, Horizontal
Barnes Co., W. F. & John.... 33
Beaman & Smith Co.....25, 94
Betts Machine Co..... 9
Detrick & Harvey Mach. Co.. 73
Fitchburg Machine Works.... 35
Fosdick Mach. Tool Co..... 32
Gisholt Machine Co..... 86
Hoefer Mfg. Co..... 69
Johnson Jr. & Co., I. H..... 89
Lucas Machine Tool Co..... 115
Manning, Maxwell & Moore...129
McCabe, J. J.....89, 130
Motch & Merryweather Machinery Co.....130
New Haven Mfg. Co..... 87
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Rochester Boring Machine Co.124
Rockford Drilling Mach. Co...132
Sellers & Co., Wm..... 38
Springfield Mach. Tool Co.... 49
Universal Boring Machine Co. 92
Vandyck Churchill Co..... 93

Boring Head, Offset
Marvin & Casler Co..... 96

Boring Tools
Armstrong Bros. Tool Co.... 84
Grant Mfg. & Machine Co....124
Western Tool & Mfg. Co.....124

Brazing
Goodyear, Inc., Nelson.....111

Broaches
Lapointe Co., J. N.....110

Broaching Machines
Harrington, Son & Co., Edwin. 91
Lapointe Mach. Tool Co..... 82
Pratt & Whitney Co..... 47

Buckets, Coal
Link-Belt Co. 1, 79

Bulldozers
Bliss Co., E. W..... 59
Niles-Bement-Pond Co....2, 3, 46
Toledo Mach. & Tool Co.....121

Burnishing Machinery
Abbott Ball Co.....113

Butt Drilling and Milling Machines
Shuster Co., F. B.....126

Cabinets, Tool
Armstrong Bros. Tool Co.... 84
Hammacher, Schlemmer & Co. 65
Morse Twist Drill & Mach. Co. 59

Calipers
Athol Machine Co.....120
Brown & Sharpe Mfg. Co..55, 136
Schuchardt & Schütte..17, 28, 96
Slocomb Co., J. T..... 98
Starrett Co., L. S..... 72

Cam Cutting Machinery
Garvin Machine Co.....75, 94
Rowbottom Machine Co.....118

Cams
Bilgram Machine Works.....105
Boston Gear Works.....102
Rowbottom Machine Co.....118

Carbonizing
American Gas Furnace Co...108

Carborundum
See Grinding Wheels.

Cars, Industrial
Link-Belt Co. 1, 79

Case-Hardening
American Gas Furnace Co...108
Chicago Flexible Shaft Co....107
Rogers & Hubbard Co.....109
Williams & Co., J. H..... 80

Castings, Aluminum
Lumen Bearing Co.....111
Mack Mfg. Co., Carl.....114
Whitlock Coil Pipe Co.....114

Castings, Brass and Bronze
Atkinson Co., The.....110
Lumen Bearing Co.....111
Mack Mfg. Co., Carl.....114
Whitlock Coil Pipe Co.....114

Castings, Die Molded
Doehler Die Casting Co.....107
Franklin Mfg. Co.....110
Lumen Bearing Co.....111
Precision Die-Casting Co.....112
Veeder Mfg. Co.....101

Castings, Iron
Athol Machine Co.....120
Brown & Sharpe Mfg. Co..55, 136
Link-Belt Co. 1, 79
Springfield Machine Tool Co.. 49
Taylor & Fenn Co..... 97
Veeder Mfg. Co..... 97

Castings, Steel
Mack Mfg. Co., Carl.....114
National Brake & Electric Co.119
United Engr. & Fdry. Co 121

Castings, Vanadium
American Vanadium Co... ..107

Cement, Iron
Smooth-On Mfg. Co.....111

Centering Machines
Hendey Machine Co..... 61
McCabe, J. J.....89, 130
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Wells & Son Co., F. E.....119
Whiton Mach. Co., D. E..... 94

Centers, Planer
Carter & Hakes Mach. Co....105
Cincinnati Planer Co..... 16
Morse Twist Drill & Mach. Co. 59
New Haven Mfg. Co..... 87
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Reed Co., F. E..... 44
Woodward & Powell Planer Co.115

Chains, Driving
Boston Gear Works.....102
Diamond Chain & Mfg. Co... 90
Link-Belt Co. 1, 79
Morse Chain Co..... 91
Whitney Mfg. Co..... 53

Chucking Machines
Acme Machine Tool Co..... 30
American Tool Wks. Co..... 8
Brown & Sharpe Mfg. Co..55, 136
Cleveland Automatic Machine Co. 18
Garvin Machine Co.....75, 94
Gisholt Machine Co..... 86
Johnson Jr. & Co., I. H..... 89
Jones & Lamson Machine Co., 12, 13, 50
LeBlond Mach. Tool Co., R. K., 63, 136
McCabe, J. J.....89, 130
Niles-Bement-Pond Co....2, 3, 46
Potter & Johnston.....20, 21
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Reed Co., F. E..... 44
Warner & Swasey Co..... .. 39
Windsor Machine Co..... . 45

Chucks, Drill
Almond Mfg. Co., T. R.. ... 94
Brown & Co., R. H..... ... 96
Celfor Tool Co..... 98
Cleveland Twist Drill Co....136
Cushman Chuck Co..... 95
Detroit Twist Drill Co..... 37
Grönkvist Drill Chuck Co..... 96
Horton & Son Co., E..... 94
Modern Tool Co.....118
Morrow Mfg. Co..... 95
Morse Twist Drill & Mach. Co. 59
Niles-Bement-Pond Co....2, 3, 46
Pratt Chuck Co..... 94
Skinner Chuck Co..... 96
Standard Tool Co..... 26
Union Mfg. Co..... 95
Whitman & Barnes Mfg. Co.. 97
Whitney Mfg. Co..... 53
Whiton Mach. Co., D. E..... 94
Wiley & Russell Mfg. Co.....100

Chucks, Lathe
Cushman Chuck Co..... 95
Gisholt Machine Co..... 86
Hoggson & Pettis Mfg. Co.... 95
Horton & Son Co., E..... 94
Horton Machine Co., S. E.... 94
Jones & Lamson Machine Co., 12, 13, 50
Modern Tool Co.....118
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Pratt Chuck Co..... 94
Skinner Chuck Co..... 96
Union Mfg. Co..... 95
Whiton Mach. Co., D. E..... 94

Chucks, Magnetic
Walker & Co., O. S.....136

Chucks, Planer
Cincinnati Planer Co..... 16
Harrington & Son Co., Edwin. 91
New Haven Mfg. Co..... 87
Niles-Bement-Pond Co....2, 3, 46
Skinner Chuck Co..... 96
Union Mfg. Co..... 95

Chucks, Split
Ames Co., B. C..... 86
Rivett Lathe Mfg. Co.....135
Sloan & Chace Mfg. Co..... 88
Stark Tool Co..... 86

Circuit Breakers
Electric Controller & Supply Co. 125
General Electric Co.....122
Westinghouse Elec. & Mfg. Co.123

Clamps
Brown & Sharpe Mfg. Co..55, 136
Hammacher, Schlemmer & Co. 65
Hoggson & Pettis Mfg. Co.... 95
St. Louis Sales Co.....105
Starrett Co., L. S..... 72
Western Tool & Mfg. Co.....124
Williams & Co., J. H..... 80

"Whitney" Hand and Weight (feed) Milling Machines

Wide range with simple construction.

Greater Power than can be obtained on any other Hand Milling Machine of an equal size.

Vertical and Horizontal Feeds are independent. This feature permits work to be held close to the Table and makes the Machine a Profiler.

The Spindle Head has Vertical Lever Feed and is accurately counterbalanced.

As the Vertical Lever Feed is independent from the Table and the Head accurately counterbalanced, light Milling may be done on long or heavy pieces without danger of breaking cutters.

The Spindle is driven by interchangeable Side Driving pulleys, which, in connection with three Grade Cone on Back Shaft, gives six Spindle Speeds.

The Table has Hand Lever Feed, also Crank Feed operated by Rack and Pinion.

The Pinion Shaft is mounted in an eccentric bushing to allow for adjustment of pinion with rack.

Weight attachment is furnished for feeding both Head and Table automatically.

Adjustable stops are furnished for limiting the travel of both Head and Table in either direction.

Table has large Oil Pockets.

Elevating Screw for Knee is provided with Ball Bearing Thrust Collars for reducing friction.

Any number of Spindle Speeds may be obtained by making new side Pulleys.

Hand lever for table feed can be applied either side of the Table to suit the operator.

The Whitney Mfg. Co., Hartford, Conn.

Manufacturers of High Grade Driving Chains, Water Tool Grinders, "The Woodruff Patent System of Keying," Presto Chucks and Friction Tapping Devices.

Foreign Agents: C. W. Burton, Griffiths & Co., London. Fenwick Freres & Co., Paris. F. G. Kretschmer & Co., Frankfurt A. M., Germany.

Clocks, Time
Calculagraph Co.....101

Clocks, Watchmen's
Holtzer-Cabot Electric Co....124

Clutches, Friction
American Tool & Machine Co. 124
Caldwell & Co., Inc., W. E.... 90
Caldwell & Sons Co., H. W...128
Evans Friction Cone Co..... 90
Johnson Mach. Co., Carlyle.. 83
Link-Belt Co. 1, 79
New Haven Mfg. Co..... 87
Niles-Bement-Pond Co....2, 3, 46

Clutches, Magnetic
Electric Controller & Supply Co. 125

Coal Handling Machinery
Link-Belt Co. 1, 79

Coilers' Spring
Garvin Machine Co.....75, 94

Collets
Whitney Mfg. Co..... 53

Compound, Pipe Joint
Dixon Crucible Co., Joseph...112
Smooth-On Mfg. Co.....111

Compressors, Air
Blanchard Machine Co...76, 101
Chicago Pneumatic Tool Co..116
Clayton Air Compressor Wks.117
Dallett Co., Thos. H.....117
Independent Pneu. Tool Co...117
Ingersoll-Rand Co. 117
Laidlaw-Dunn-Gordon Co.....116
National Brake & Electric Co.119
Sullivan Machinery Co.....117

Compressors, Gas
Chicago Pneumatic Tool Co..116
Ingersoll-Rand Co.....117

Conduit, Interior
Sprague Electric Works.....123

Cones, Friction
Evans Friction Cone Co..... 90

Connecting Rods and Straps
Electric Welding Products Co.,110
Standard Gauge Steel Co.....112
Tindel-Morris Co..... 93

Contract Work
Blanchard Machine Co...76, 101
Cowdrey Mach. Wks., C. H...127
Meisel Press & Mfg. Co....102
Merritt, Jos..... 50
Morrow Mfg. Co..... 95
Poole Engineering & Mach. Co.104
Rowbottom Machine Co.....118
Sloan & Chace Mfg. Co..... 88
Taft-Peirce Mfg. Co.....132
Weeks, C. S.....105

Controllers and Starters, Electric
General Electric Co.....122
Westinghouse Elec. & Mfg. Co.123

Conveying Machinery
Brown Hoisting Mchry. Co.. 90
Link-Belt Co. 1, 79
Manning, Maxwell & Moore...129

Coping Machines
Long & Allstatter Co.....126
Niles-Bement-Pond Co....2, 3, 46

Corundum
See Grinding Wheels.

Cotter Pin Machinery
Shuster Co., F. B.....126

Cotters
Cleveland Twist Drill Co....136
Morse Twist Drill & Mach. Co. 59
Shuster Co., F. B.....126
Standard Tool Co..... 26
Union Twist Drill Co..... 67
Whitman & Barnes Co..... 97

Counterbores
Cleveland Twist Drill Co....136
Detroit Twist Drill Co..... 97
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Slocomb Co., J. T..... 98
Starrett Co., L. S..... 72

Counters, Revolution
Durbrow & Hearne Mfg. Co...101
Grant Mfg. & Machine Co....124
Recording Register and Fare Box Co. 101
Root Co., C. J.....101
Schuchardt & Schütte..17, 28, 96
Veeder Mfg. Co.....101

Countershafts
Almond Mfg. Co., T. R..... 94
Brown & Sharpe Mfg. Co..55, 136
Coates Clipper Mfg. Co.....129
Dill Slotter People.....115

Countershafts—*Continued.*
Evans Friction Cone Co..... 90
Grant Mfg. & Mach. Co.....124
LeBlond Mach. Tool Co., R. K., 63, 136
McCabe, J. J.....89, 130
Manufacturing Equipment and Engineering Co.....101
Norton Grinding Co..... 68
Safety Emery Wheel Co.....119

Countershafts, Friction
Dill Slotter People.....115
Evans Friction Cone Co..... 90
Warner & Swasey Co..... 39
Wilmarth & Morman Co.....120

Counting and Printing Wheels
Doehler Die Casting Co.....107
Franklin Mfg. Co.....110

Counting Machines
Recording Register and Fare Box Co. 101

Couplers, Hose
Chicago Pneumatic Tool Co...116
Greene, Tweed & Co..... 96
Independent Pneu. Tool Co...117
Ingersoll-Rand Co.....117

Couplings
Almond Mfg. Co., T. R..... 94
Caldwell & Sons Co., H. W...128
Electric Controlling & Supply Co. 125
National Tube Co.....111
Nicholson & Co., W. H..... 75
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Standard Gauge Steel Co.....112

Cranes
Brown Hoisting Mchry. Co.... 90
Chicago Pneumatic Tool Co...116
Link-Belt Co. 1, 79
Manning, Maxwell & Moore...129
Maris Bros..... 90
Moore Co., Franklin..... 92
Niles-Bement-Pond Co....2, 3, 46
Northern Engineering Works. 90
Sellers & Co., Wm..... 38
Shaw Electric Crane Co..... 90
Shepard Electric Crane & Hoist Co. 92
Toledo Bridge & Crane Co.... 90
United Engr. & Fdry. Co.....121
Vandyck Churchill Co..... 93
Yale & Towne Mfg. Co..... 91

Crank Pin Turning Machines
Niles-Bement-Pond Co....2, 3, 46

Crank Shafts
Standard Gauge Steel Co.....112
Tindel-Morris Co..... 93

Crucibles
Dixon Crucible Co., Jos.....112

Crushers
Niles Bement-Pond Co....2, 3, 46

Cupolas and Ladles, Foundry
Paxson Co., J. W.....117

Cutters, Milling
Adams Co.....104
Barber-Colman Co. 37
Becker Milling Machine Co... 23
Boker & Co., Hermann..... 77
Brown & Sharpe Mfg. Co..55, 136
Cleveland Twist Drill Co....136
Detroit Twist Drill Co..... 97
Ingersoll Milling Machine Co. 4
Kearney & Trecker..... 26
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Sloan & Chace Mfg. Co..... 88
Standard Tool Co..... 26
Union Twist Drill Co..... 67
Ward & Son, Edgar T.....113

Cutting-Off Machines
Armstrong Bros. Tool Co..... 84
Bignall & Keeler Mfg. Co.....127
Brown & Sharpe Mfg. Co..55, 136
Hurlbut Rogers Mach. Co.....128
Johnson Jr. & Co., I. H..... 89
McCabe, J. J.....89, 130
Newton Machine Tool Wks... 19
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Tindel-Morris Co..... 93
Warner & Swasey Co..... 39

Cutting-Off Tools
Armstrong Bros. Tool Co..... 84
Billings & Spencer Co..... 92
Cleveland Twist Drill Co....136
Pratt & Whitney Co..... 47
Western Tool & Mfg. Co.....124

Cyclometers
Veeder Mfg. Co.....101

Diamond Tools
American Emery Wheel Wks.120
Dessau's Sons, S.....119
Dickinson, Thos. I..... 50
Safety Emery Wheel Co.....119

Dies, Sheet Metal
Bliss Co., E. W..... 59
Columbus Die, Tool & Mach. Co. 99
Ferracute Machine Co.....121
New Haven Mfg. Co..... 87
Niagara Machine & Tool Wks.121
Pratt & Whitney Co..... 47
Taft-Peirce Mfg. Co.....132
Toledo Mach. & Tool Co....121
Waltham Machine Works.... 86

Dies, Sub-Press
Pratt & Whitney Co..... 47
Sloan & Chace Mfg. Co..... 88
Taft-Peirce Mfg. Co.....132
Waltham Machine Works.... 86

Dies, Threading, Opening
Boker & Co., Hermann..... 77
Errington, F. A..... 95
Foote-Burt Co..... 99
Geometric Tool Co..... 42
Jones & Lamson Mach. Co., 12, 13, 50
Modern Tool Co.....118
Pratt & Whitney Co..... 47
Warner & Swasey Co..... 39

Drawing Boards and Tables
Washburn Shops.....118

Drill Heads, Hydro-Pneumatic
Foster Co., Walter H..... 89

Drill Speeder
Graham Mfg. Co.....105

Drilling Compound
White & Bagley.....119

Drilling Machines, Bench
Barnes Co., W. F. & John.... 33
Hoefer Mfg. Co..... 69
Pratt & Whitney Co..... 47
Prentice Bros. Co..... 29
Rockford Drilling Mach. Co..132
Sigourney Tool Co..... 97
Sloan & Chace Mfg. Co..... 88
U. S. Electrical Tool Co.....100

Drilling Machines, Boiler
American Tool Works Co..... 8
Cincinnati Bickford Tool Co., 10, 11
Foote-Burt Co..... 99
McCabe, J. J.....89, 130
Niles-Bement-Pond Co....2, 3, 46
Prentice Bros. Co..... 29
Sellers & Co., Wm..... 38

Drilling Machines, Multiple Spindle
American Tool Wks. Co..... 8
Baker Bros. 120
Barnes Co., W. F. & John.... 33
Barnes Drill Co..... 98
Baush Mach. Tool Co..... 36
Cincinnati Bickford Tool Co., 10, 11
Foote-Burt Co..... 99
Fosdick Mach. Tool Co..... 32
Garvin Machine Co.....75, 94
Harrington, Son & Co., Edwin. 91
Henry & Wright Mfg. Co..... 43
Hoefer Mfg. Co..... 69
Leland & Co., W. H..... 98
Manning, Maxwell & Moore...129
McCabe, J. J.....89, 130
Newton Mach. Tool Works... 19
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentice Bros. Co..... 29
Prentiss Tool & Supply Co...130
Rockford Drilling Mach. Co..132
Sigourney Tool Co..... 97
Sellers & Co., Wm..... 38
Taylor & Fenn Co..... 97

Drilling Machines, Portable
Chicago Pneumatic Tool Co...116
Coates Clipper Mfg. Co..... 76
Dallett, Thos. H.....117
Gem Mfg. Co.....119
Ingersoll-Rand Co.....117
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Rochester Boring Machine Co.124
U. S. Electrical Tool Co.....100

Drilling Machines, Radial
American Tool Works Co..... 8
Baush Mach. Tool Co..... 36
Cincinnati Bickford Tool Co., 10, 11
Detrick & Harvey Mach. Co.. 73
Dreses Mach. Tool Co..... 22
Foote-Burt Co..... 99
Fosdick Mach. Tool Co..... 32
Foster Co., Walter H..... 89
Gang Co., Wm. E..... 98
Manning, Maxwell & Moore...129
Marshall & Huschart Machry. Co. 131
McCabe, J. J.....89, 130
Morris Mach. Tool Co., Jno. B.112
Mueller Mach. Tool Co..... 98
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Prentice Bros. Co..... 29

Drilling Machines, Radial—*Continued.*
Prentiss Tool & Supply Co...130
Sellers & Co., Wm..... 38
Wormer Mchy. Co., C. C.....131

Drilling Machines, Rail
Foote-Burt Co..... 99
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Standard Tool Co..... 26

Drilling Machines, Turret
Niles-Bement-Pond Co....2, 3, 46

Drilling Machines, Upright
Baker Bros. 120
Barnes Co., W. F. & John.... 33
Barnes Drill Co..... 98
Beaman & Smith Co.....25, 94
Celfor Tool Co..... 98
Cincinnati Bickford Tool Co., 10, 11
Foote-Burt Co. 99
Fosdick Mach. Tool Co..... 32
Frontier Iron Works..... 99
Gould & Eberhardt..... 31
Harrington, Son & Co., Edwin. 91
Henry & Wright Mfg. Co..... 43
Hoefer Mfg. Co..... 69
Leland & Co., W. H..... 98
Manning, Maxwell & Moore...129
Marshall & Huschart Machry. Co. 131
McCabe, J. J.....89, 130
Morse Twist Drill & Mach. Co. 59
New Haven Mfg. Co..... 87
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentice Bros. Co..... 29
Prentiss Tool & Supply Co...130
Rockford Drilling Mach. Co..132
Sellers & Co., Wm..... 38
Sibley Machine Tool Co..... 80
Sigourney Tool Co..... 97
Sloan & Chace Mfg. Co..... 88
Taylor & Fenn Co..... 97
Washburn Shops.....118
Wiley & Russell Mfg. Co.....100
Wormer Machry. Co., C. C....131

Drills, Center
Cleveland Twist Drill Co.. 136
Detroit Twist Drill Co..... 97
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Slocomb Co., J. T..... 98
Standard Tool Co..... 26
Whitman & Barnes Mfg. Co.. 97

Drills, Electric
Chicago Pneumatic Tool Co...116
Independent Pneu. Tool Co...117
U. S. Electrical Tool Co.....100

Drills, Flat
Celfor Tool Co..... 98
Lincoln-Williams Twist Drill Co. 99
Pratt & Whitney Co..... 47
Whitman & Barnes Mfg. Co.. 97

Drills, Hand
Chicago Pneumatic Tool Co...116
Coates Clipper Mfg. Co.....129
Ingersoll-Rand Co.....117
Niles-Bement-Pond Co....2, 3, 46
U. S. Electrical Tool Co.....100

Drills, Pneumatic
Chicago Pneumatic Tool Co..116
Clayton Air Compressor Wks.117
Foster Co., Walter H..... 89
Independent Pneu. Tool Co...117
Ingersoll-Rand Co.....117
Sullivan Machinery Co.....117

Drills, Ratchet
Armstrong Bros. Tool Co..... 84
Boker & Co., Hermann..... 77
Chicago Pneumatic Tool Co...116
Cleveland Twist Drill Co....136
Curtis & Curtis Co.....127
Detroit Twist Drill Co..... 97
Greene, Tweed & Co..... 96
Parker Co., Chas.....105
Pratt & Whitney Co..... 47
Standard Tool Co..... 26
Whitman & Barnes Mfg. Co.. 97

Drills, Rock
Chicago Pneumatic Tool Co..116
Ingersoll-Rand Co.....117
Sullivan Machinery Co.....117

Drills, Twist
Pratt & Whitney Co..... 47

Dynamometers, Electric
General Electric Co.....122
Sprague Electric Works.....123

Dynamos
Burke Electric Co.....124
General Electric Co.....122
Holtzer-Cabot Electric Co....124
Reliance Electric & Engr. Co.124
Roth Bros. & Co.....124
Sprague Electric Works.....123
Triumph Electric Co.....123
Westinghouse Elec. & Mfg. Co.123

ACCURATE—RIGID—LIGHT

MICROMETER CALIPERS, NOS. 82-100

(Capacity; 1" to 20" or 25 m/m 500 m/m)

These Calipers were designed with the purpose of making a set of measuring tools that would be exceptionally well adapted for machine shop equipment.

The frame of each Caliper is made of I—section which combines the greatest strength and rigidity with lightness. Note the new design of the frame—a B & S feature.

They are accurate in their measurements, convenient to handle and inexpensive. Each Caliper has a movement of 1" by .001ths. or of 25 m/m by 100ths of a m/m.

Sold Singly Or In Sets

When furnished in sets they are carefully packed in a substantial wooden case.

The sets are made up as follows:

6 Calipers, 6" to 12", 150 m/m to 300 m/m
11 Calipers, 1" to 12", 25 m/m to 300 m/m
19 Calipers, 1" to 20", 25 m/m to 500 m/m

We show a full line of Calipers of different styles and designs in our catalogue

Brown & Sharpe Manufacturing Co.

Providence, R. I., U. S. A.

Electrical Instruments
Brown Instrument Co.....101

Electrical Supplies
Electric Controller & Supply Co. 125
General Electric Co.....122
Triumph Electric Co.....123
Westinghouse Elec. & Mfg. Co. 123

Electrically Driven Tools
Electric Controller & Supply Co. 125

Elevators
Harrington, Son & Co., Edwin. 91
Link-Belt Co. 1, 79

Emery Wheel Dressers
American Emery Wheel Wks. 120
Dessau's Sons, S.....119
Dickinson, Thos. L..... 50
Greene, Tweed & Co..... 96
Reed Mfg. Co.....105
Safety Emery Wheel Co.....119
Standard Tool Co..... 26
Vitrified Wheel Co.....118

Emery Wheels
See Grinding Wheels.

Enamel Machinery
Glidden Varnish Co..... 108

Enclosures, Tool-Room
Hart & Cooley Co..... 75

Engineers, Mechanical or Electrical
Link-Belt Co. 1, 79
Merritt, Jos.....50
Taft-Peirce Mfg. Co.....132
Weeks, C. S.....105
Wells & Soulis.....124

Engines, Automobile
Doehler Die Casting Co.....107
Franklin Mfg. Co.....110

Engines, Gas and Gasolene
Automatic Machine Co..... 61
Grant Mfg. & Mach. Co 124
Otto Gas Engine Co.....105

Engines, Steam
Nazel Engr. & Mach. Wks...121

Engraving Machinery
Gorton Mach. Co., Geo.....112

Expanders, Tube
Chicago Pneumatic Tool Co.. 116
Nicholson & Co., W. H..... 75
Pratt & Whitney Co..... 47
Watson-Stillman Co..... 77

Fans, Electric
General Electric Co.....122
Sprague Electric Works.....123
Westinghouse Elec. & Mfg. Co. 123

Fans, Exhaust
General Electric Co.....122
Westinghouse Elec. & Mfg. Co. 123

Files and Rasps
Barnett Co., G. & H..... 50
Hammacher, Schlemmer & Co. 65
Nicholson File Co..... 17
Simonds Mfg. Co..... 93
Whitman & Barnes Mfg. Co.. 97

Filing Machines
Detrick & Harvey Mach. Tool Co. 73
Grant Mfg. & Machine Co....124
Simplex Mfg. Co..... 93

Filler, Iron
National Tube Co.....111

Fittings, Hydraulic
Watson-Stillman Co..... 77

Fittings, Steam
National Tube Co.....111
Walworth Mfg. Co..... 50

Flanges
Dart Mfg. Co., E. M.....100
National Tube Co.....111

Flexible Shafts
Chicago Flexible Shaft Co...107
Coates Clipper Mfg. Co.....129
Gem Mfg. Co.....119

Forging Machinery
National Machinery Co.....126

Forgings, Drop
Billings & Spencer Co..... 92
Bliss Co., E. W..... 59
Brown & Co., R. H..... 96
Machinery Forging Co.....111
Page-Storms Drop Forge Co..114
Williams & Co., J. H..... 80

Forgings, Machine
Machinery Forging Co.....111
Tindel-Morris Co..... 93

Forgings, Steel
Crucible Steel Co. of America. 109

Forgings, Vanadium
American Vanadium Co.....107
Crucible Steel Co. of America. 109

Foundry Furnishings
Adams Co.....104
Pangborn Company, Thos. W. 117
Paxson Co., J. W.....117

Frictions, Paper and Iron
Link-Belt Co. 1, 79
Rockwood Mfg. Co..... 90

Furnaces, Annealing and Tempering
American Gas Furnace Co...108
Billings & Spencer Co..... 92
Brown & Sharpe Mfg. Co..55, 136
Chicago Flexible Shaft Co...107
General Electric Co.....122
Gilbert & Barker Mfg. Co....109
Hoskins Mfg. Co.....115
Tate, Jones & Co.....114

Furnaces, Coal and Oil
Gilbert & Barker Mfg. Co....109
Tate, Jones & Co.....114

Furnaces, Electric
Brown Instrument Co.....101
General Electric Co.....122
Hoskins Mfg. Co.....115

Furnaces, Gas
American Gas Furnace Co...108
Chicago Flexible Shaft Co... 107
Gilbert & Barker Mfg. Co....109

Furnaces, Melting
American Gas Furnace Co...108
Chicago Flexible Shaft Co....107

Furnaces, Welding
Gilbert & Barker Mfg. Co....109
Toledo Electric Welder Co...111

Furniture, Machine Shop
Hart & Cooley Co..... 75
Manufacturing Equipment & Engineering Co.....101
Page-Storms Drop Forge Co..114
Western Tool & Mfg. Co.....124

Gages, Dial
Ames Co., B. C..... 86

Gages, Recording
Bristol Co.....136
Brown Instrument Co.....101

Gages, Standard
Brown & Sharpe Mfg. Co..55, 136
Cleveland Twist Drill Co.....136
Grönkvist Drill Chuck Co.... 96
Henry & Wright Mfg. Co..... 43
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Slocomb Co., J. T..... 98
Starrett Co., L. S..... 72
Wells Bros. Co.....100

Gaskets
Greene, Tweed & Co..... 96
Smooth-On Mfg. Co.....111

Gear Blanks, Hard Fiber
Delaware Hard Fibre Co., Ltd. 91

Gear Cutting Machinery
Adams Co.....104
Becker Milling Machine Co.... 23
Bilgram Machine Works.....105
Brown & Sharpe Mfg. Co..55, 136
Cincinnati Gear Cutting Machine Co..... 48
Cincinnati Shaper Co..... 48
Clough, R. M..... 99
Fellows Gear Shaper Co..... 24
Flather Mfg. Co., E. J.....105
Foote Bros. Gear & Mach. Co. 104
Garvin Machine Co.....75, 94
Gould & Eberhardt..... 31
Harrington, Son & Co., Edwin. 91
Marshall & Huschart Machry. Co. 131
McCabe, J. J.....89, 130
Meisselbach-Catucci Mfg. Co.. 104
Motch & Merryweather Co.... 130
New Britain Machine Co.... 84
Newark Gear Cutting Machine Co. 104
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Schuchardt & Schütte..17, 28, 96
Sloan & Chace Mfg. Co..... 88
Waltham Machine Works..... 86
Whiton Machine Co., D. E.... 94

Gear Testing Machinery
Gisholt Machine Co..... 86
Morse Twist Drill & Mach. Co. 59

Gears, Cut
Adams Co.....104
American Vanadium Co.....107
Bilgram Machine Works.....105
Boston Gear Works.....102
Brown, A. & F.....104
Brown & Sharpe Mfg. Co..55, 136

Gears, Cut—*Continued.*
Caldwell & Son Co., H. W....128
Chicago Rawhide Mfg. Co....104
Cincinnati Gear Co.....102
Clough, R. M..... 99
Earle Gear & Machine Co....104
Fawcus Machine Co.....102
Fellows Gear Shaper Co..... 24
Flather Mfg. Co., E. J.....105
Foote Bros. Gear & Mach. Co. 104
Garvin Machine Co.....75, 94
Gould & Eberhardt..... 31
Grant Gear Works.....102
Harrington, Son & Co., Edwin. 91
Horsburgh & Scott Co.....105
Link-Belt Co. 1, 79
Meisel Press & Mfg. Co.....102
Meisselbach-Catucci Mfg. Co.. 104
New Process Rawhide Co.....103
Newark Gear Cutting Machine Co. 104
Nuttall Co., R. D.....102
Philadelphia Gear Works....102
Poole Engr. & Mach. Co.....104
Sawyer Gear Works.....102
Simonds Mfg. Co., The.....102
Taylor-Wilson Mfg. Co.....104
Toledo Bridge & Crane Co.... 90

Gears, Molded
Brown, A. & F.....104
Caldwell & Sons Co., H. W...128
Doehler Die Casting Co.....107
Franklin Mfg. Co.....110
Horsburgh & Scott Co.....105
Link-Belt Co. 1, 79
Philadelphia Gear Works....102
Poole Engr. & Mach. Co.....104
Precision Die-Casting Co.....112
Taylor-Wilson Mfg. Co.....104

Gears, Rawhide
Brown, A. & F.....104
Boston Gear Works.....102
Chicago Rawhide Mfg. Co....104
Cincinnati Gear Co.....102
Earle Gear & Mach. Co.....104
Foote Bros. Gear & Mach. Co. 104
Gould & Eberhardt..... 31
Grant Gear Works.....102
Horsburgh & Scott Co.....105
New Process Rawhide Co.....103
Nuttall Co., R. D.....102
Philadelphia Gear Works....102
Sawyer Gear Works.....102

Gears, Worm
Boston Gear Works.....102
Brown & Sharpe Mfg. Co..55, 136
Cincinnati Gear Co.....102
Earle Gear & Machine Co....104
Fawcus Machine Co.....102
Foote Bros. Gear & Mach. Co. 104
Gould & Eberhardt..... 31
Horsburgh & Scott Co.....105
Link-Belt Co. 1, 79
Newark Gear Cutting Machine Co. 104
Nuttall Co., R. D.....102
Philadelphia Gear Works....102
Taylor-Wilson Mfg. Co.....104

Generating Sets
Burke Electric Co.....124
General Electric Co.....122
Richmond Electric Co.....124
Sprague Electric Works.....123
Triumph Electric Co.....123
Westinghouse Elec. & Mfg. Co. 123

Generators, Gas
American Gas Furnace Co....108

Graphite
Dixon Crucible Co., Jos.....112

Grinders, Bench
Athol Machine Co.....128
Chicago Pneumatic Tool Co..116
Diamond Machine Co.....120
Modern Tool Co.....118
Pratt & Whitney Co..... 47
U. S. Electrical Tool Co.....100
Walker & Co., O. S.....136

Grinders, Center
Coates Clipper Mfg. Co.....129
Diamond Machine Co.....120
Gem Mfg. Co.....119
Greenfield Machine Co.....120
Mueller Machine Tool Co..... 98
Niles-Bement-Pond Co....2, 3, 46
U. S. Electrical Tool Co.....100

Grinders, Chucking
Bryant Chucking Grinder Co. 25
Pratt & Whitney Co..... 47

Grinders, Cutlery
Hemming Bros. Co.....126

Grinders, Cutter
Bath Grinder Co..... 65
Becker Milling Machine Co... 23
Blake & Johnson Co.....120
Brown & Sharpe Mfg. Co..55, 136
Cincinnati Milling Mach. Co...6, 7
Gould & Eberhardt..... 31
Greenfield Machine Co.....120
Heald Machine Co..... 34
Ingersoll Milling Mach. Co... 4
LeBlond Mach. Tool Co., R. K.. 63, 136

Grinders, Cutter—*Continued.*
Leland & Co., W. H..... 98
Modern Tool Co.....118
Niles-Bement-Pond Co....2, 3, 46
Norton Grinding Co..... 68
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Rivett Lathe Mfg. Co.....135
U. S. Electrical Tool Co.....100
Wells & Son Co., F. E.....119
Wilmarth & Morman Co.....120

Grinders, Cylindrical
Bath Grinder Co..... 65
Brown & Sharpe Mfg. Co..55, 136
Bryant Chucking Grinder Co. 25
Diamond Machine Co.....120
Greenfield Machine Co.....120
Heald Machine Co..... 34
Landis Tool Co..... 57
Leland & Co., W. H..... 98
Modern Tool Co.....118
Morse Twist Drill & Mach. Co. 59
Norton Grinding Co..... 68
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
U. S. Electrical Tool Co.....100

Grinders, Disc
Bath Grinder Co..... 65
Besly & Co., Chas. H..... 85
Bryant Chucking Grinder Co. 25
Diamond Machine Co.....120
Gardner Machine Co.....118
Prentiss Tool & Supply Co...130
Ransom Mfg. Co..... 118
Rowbottom Machine Co.....118
Safety Emery Wheel Co.....119
Taylor & Fenn Co..... 97

Grinders, Drill
Heald Machine Co..... 34
Morse Twist Drill & Mach. Co. 59
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Safety Emery Wheel Co.....119
Sellers & Co., Wm..... 38
Standard Tool Co..... 26
U. S. Electrical Tool Co.....100
Washburn Shops.....118
Wilmarth & Morman Co.....120

Grinders, Internal
Bath Grinder Co..... 65
Brown & Sharpe Mfg. Co..55, 136
Bryant Chucking Grinder Co. 25
Diamond Machine Co.....120
Grant Mfg. & Mach. Co.....124
Greenfield Machine Co.....120
Heald Machine Co..... 34
Landis Tool Co..... 57
Leland & Co., W. H..... 98
Modern Tool Co.....118
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....135
U. S. Electrical Tool Co.....100

Grinders, Knife
Safety Emery Wheel Co.....119

Grinders, Plain
Blake & Johnson Co.....120
La Salle Machine Tool Co....118
Modern Tool Co.....118

Grinders, Portable
Chicago Pneumatic Tool Co..116
Coates Clipper Mfg. Co.....129
U. S. Electrical Tool Co.....100

Grinders, Saw
Tindel-Morris Co..... 93

Grinders, Surface
Blake & Johnson Co.....120
Blanchard Machine Co....76, 101
Garvin Machine Co.....75, 94
Heald Machine Co..... 34
Hemming Bros. Co.....126
La Salle Machine Tool Co....118
Leland & Co., W. H..... 98
Pratt & Whitney Co..... 47
Rowbottom Machine Co.....118
U. S. Electrical Tool Co.....100

Grinders, Tool
Armstrong Bros. Tool Co.... 84
Barnes Co., W. F. & John.... 33
Bath Grinder Co..... 65
Blake & Johnson Co.....120
Blount Co., J. G.....119
Brown & Sharpe Mfg. Co..55, 136
Cincinnati Milling Mach. Co...6, 7
Diamond Mach. Co.....120
Gisholt Machine Co..... 86
Gould & Eberhardt..... 31
Grant Mfg. & Mach. Co.....124
Greenfield Machine Co.....120
Landis Tool Co..... 57
La Salle Machine Tool Co....118
LeBlond Mach. Tool Co., R. K.. 63, 136
Leland & Co., W. H..... 98
McCabe, J. J.....89, 130
Modern Tool Co.....118
Morse Twist Drill & Mach. Co. 59
Newark Gear Cutting Machine Co. 104
Niles-Bement-Pond Co....2, 3, 46
Norton Grinding Co..... 68
Pratt & Whitney Co..... 47

Grinding Talks

In Thirteen Weekly Chapters

Number Seven

Truing Of Grinding Wheels

Chatter and waviness in appearance of the finished part are usually caused either by the wheel spindle being loose in its bearings, the grinding wheel out of true or out of balance, or particles of the material ground having become embedded in the wheel. In a great majority of cases, however, the cause of imperfect work is due to the wheel getting out of shape.

It is important that the face of the wheel should be perfectly parallel with the travel of the carriage, and in order to secure this condition, a diamond tool must be used near the point where the grinding wheel comes in contact with the work, and on small work close to the footstock center. Where the work is not so small, say 2 inches in diameter, the truing device can be clamped at the most convenient point, and, in either case, care should be exercised so that the stud holding the diamond and the arm supporting same are held solidly against the work. If the truing device is not rigid, the grinding wheel will not be true.

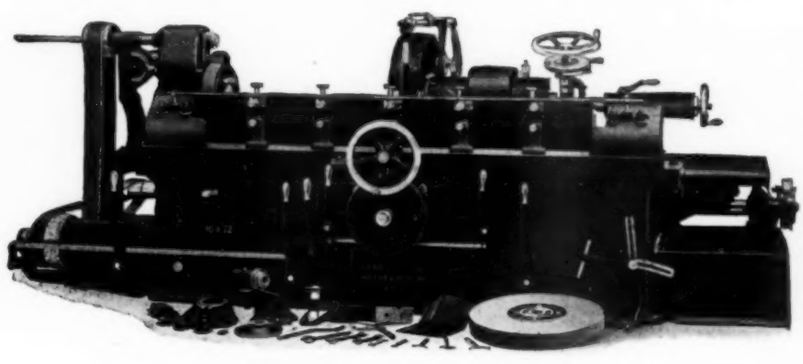
It will be observed that the stud, in which the diamond is mounted, can be revolved in its holder, and it is important that the diamond point presented to the wheel should be sharp; for instance, if the diamond should become worn and flattened, it should be turned in its holder and thus present a new point to the wheel. Keeping the wheel true is one of the important points for the operator to observe, particularly so when he comes to make a final finish. The wheel should be traversed by the diamond rapidly until it is true; the traverse should then be slowed down to give the wheel its final finish. If it is desired to do rapid cutting when roughing, it will be found proper to pass the wheel by the diamond rapidly, thus making a rougher face on the wheel.

The number of times the face of the grinding wheel has to be trued depends entirely on the character of work being finished and the kind of wheel used. There are some wheels that wear away rapidly enough, so that little truing is necessary. There are also cases where a harder wheel is desirable, and a hard wheel necessarily requires more truing than a soft one. Where pieces are rather large and considerable stock has to be removed, it may be necessary to true the wheel each time a piece receives its finishing cut.

As stated, it is desirable, generally, to present a sharp point of the diamond to the wheel in truing, but there are times when the smooth surface is preferable, particularly when it comes to producing a very fine finish; the flat surface of the diamond will tend somewhat to glaze the wheel and thus produce a better finish.

Next Week—"About Grinding Wheels"

Strictly Manufacturing Machines



Plain Self-Contained Grinding Machine

These manufacturing machines are adapted for straight and taper cylindrical shafts, spindles, pistons, Corliss valves, plungers, tubing, and are especially desirable for grinding hardened steel and iron rolls.

In the Landis the grinding wheel carriage, which is a fixed weight, is the traversing member.

The advantages of this principle are: Unvaried duty imposed at all times upon the carrriage driving mechanism, insuring accuracy of traveling distance between points of reversal.

Uniform and positive lubrication of the ways.

A rigid and stationary foundation for the work, whatever its length or weight. No overhanging of the work table, it being supported its entire length by the main column of the machine to which it is firmly clamped—thus avoiding vibration—a feature which is so essential to rapid and accurate grinding.

This principle also eliminates that undesirable condition, experienced with machines where the work traverses, caused by the momentum of the piece of work against the footstock center when reversing the traverse at the footstock end and which tends to pound the center, producing a looseness and rendering futile any attempts to get round and accurate work.

It will pay you to look into these machines. Write for circular.

Landis Tool Company

Main Office and Works: Waynesboro, Pa., U. S. A.

Grinders, Tool—*Continued.*
Prentiss Tool & Supply Co...130
Ransom Mfg. Co.....118
Rivett Lathe Mfg. Co.....135
Rockford Drilling Mach. Co...132
Rowbottom Machine Co.....118
Safety Emery Wheel Co.....119
Sellers & Co., Wm.....38
Standard Tool Co.....26
Tabor Mfg. Co.....113
U. S. Electrical Tool Co.....100
Vandyck Churchill Co.....93
Vitrified Wheel Co.....118
Walker & Co., O. S.....136
Wells & Son Co., F. E.....119
Whitney Mfg. Co.....53
Wilmarth & Morman Co.....120

Grinding or Polishing Machines
Abbott Ball Co.....113
American Emery Wheel Wks.120
Barnes Co., W. F. & John....33
Bath Grinder Co.....65
Besly & Co., Chas. H.....85
Blake & Johnson Co.....120
Blanchard Machine Co....76, 101
Blount Co., J. G.....119
Brown & Sharpe Mfg. Co..55, 136
Bryant Chucking Grinder Co..25
Chicago Pneumatic Tool Co...116
Coates Clipper Mfg. Co.....129
Diamond Machine Co.....120
Gardner Machine Co.....118
Grant Mfg. & Mach. Co.....124
Greenfield Machine Co.....120
Harrington, Son & Co., Edwin. 91
Heald Machine Co.....34
Hemming Bros. Co.....126
Holtzer-Cabot Electric Co....124
Landis Tool Co.....57
Leland & Co., W. H.....98
McCabe, J. J.....89, 130
Newton Machine Tool Wks...19
Niles-Bement-Pond Co....2, 3, 46
Norton Grinding Co.....68
Ransom Mfg. Co.....118
Rivett Lathe Mfg. Co.....135
Rowbottom Machine Co.....118
Safety Emery Wheel Co.....110
Sterling Emery Wheel Mfg. Co.110
U. S. Electrical Tool Co.....100
Vitrified Wheel Co.....118
Wells & Son Co., F. E.....119

Grinding Wheels
American Emery Wheel Wks.120
Carborundum Co.....42
Coates Clipper Mfg. Co.....129
Diamond Machine Co.....120
Dickinson, Thos. L.....50
Niles-Bement-Pond Co....2, 3, 46
Norton Co.....69
Safety Emery Wheel Co.....119
Sterling Emery Wheel Mfg. Co.119
Vitrified Wheel Co.....118
Whitney Mfg. Co.....53

Grindstones and Frames
Brown & Sharpe Mfg. Co..55, 136
Niles-Bement-Pond Co....2, 3, 46
Norton Co.....69
Sterling Emery Wheel Mfg. Co.119
Whitman & Barnes Mfg. Co..97

Gun Barrel Machinery
Diamond Machine Co.....120
Pratt & Whitney Co.....47
Reed Co., F. E.....44

Hammers, Air
Nazel Engr. Machine Works..121

Hammers, Belt Driven
Nazel Engr. Machine Works..121
Prentiss Tool & Supply Co...130

Hammers, Drop
Billings & Spencer Co.....92
Bliss Co., E. W.....59
Gould & Eberhardt.....31
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co....130
Toledo Mach. & Tool Co.....121
Waterbury Farrel Fdry. and Mach. Co.....50

Hammers, Pneumatic
Bliss Co., E. W.....59
Chicago Pneumatic Tool Co..116
Clayton Air Compressor Wks.117
Dallett Co., Thos. H.....117
Independent Pneu. Tool Co...117
Ingersoll-Rand Co.....117
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm.....38

Hammers, Steam
Manning, Maxwell & Moore...129
Marshall & Huschart Machry. Co.....131
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm.....38
Vandyck Churchill Co.....93

Handles
Osgood, J. L.....92
Western Tool & Mfg. Co.....124

Hangers, Shafting
Brown & Sharpe Mfg. Co..55, 136
Hess-Bright Mfg. Co.....78
Hyatt Roller Bearing Co.....92
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm.....38

Hard Fiber Specialties
Delaware Hard Fibre Co., Ltd. 91

Hardening and Tempering
General Electric Co.....122

Hobbing Machines, Gear
Barber-Colman Co.....37
New Britain Machine Co....84

Hobbing Machines, Worm
Adams Co.....104
Brown & Sharpe Mfg. Co..55, 136
Gould & Eberhardt.....31
Meisselbach-Catucci Mfg. Co..104
Newark Gear Cutting Machine Co.....104
Newton Machine Tool Wks...19
Pratt & Whitney Co.....47
Schuchardt & Schütte..17, 28, 96

Hoisting and Conveying Machinery
Caldwell & Sons Co., H. W...128
Link-Belt Co.....1, 79
Niles-Bement-Pond Co....2, 3, 46
United Engr. & Fdry. Co....121
Yale & Towne Mfg. Co.....91

Hoists, Electric
Chicago Pneumatic Tool Co..116
General Electric Co.....122
Maris Bros.....90
Niles-Bement-Pond Co....2, 3, 46
Northern Engineering Wks...90
Shaw Electric Crane Co.....90
Shepard Electric Crane and Hoist Co.....92
Sprague Electric Works.....123
Westinghouse Elec. & Mfg. Co.123
Yale & Towne Mfg. Co.....91

Hoists, Hand
Harrington, Son & Co., Edwin. 91
Moore Co., Franklin.....92
Niles-Bement-Pond Co....2, 3, 46
Yale & Towne Mfg. Co.....91

Hoists, Pneumatic
Chicago Pneumatic Tool Co..116
Independent Pneu. Tool Co...117
Ingersoll-Rand Co.....117
Northern Engineering Wks...90
Shepard Electric Crane and Hoist Co.....92

Hones
Carborundum Co.....42

Hose
Chicago Pneumatic Tool Co..116
Sprague Electric Works.....123

Igniters, Gas Engine
Doehler Die Casting Co.....107
Franklin Mfg. Co.....110

Indexing Machines
Springfield Machine Tool Co.. 49

Indicators, Speed
Brown Instrument Co.....101
Brown & Sharpe Mfg. Co..55, 136
Grant Mfg. & Mach. Co.....124
Greene, Tweed & Co.....96
Starrett Co., L. S.....72
Veeder Mfg. Co.....101

Indicators, Test
Brown & Sharpe Mfg. Co..55, 136
Norton Grinding Co.....68
Starrett Co., L. S.....72

Injectors
Sellers & Co., Wm.....38

Instruments, Steel Hardness Measuring
Shore Instrument & Mfg. Co..113

Iron Bar
Milton Mfg. Co.....67

Jacks, Hydraulic
Elmes Engineering Works, Chas. F.....121
Watson-Stillman Co.....77

Jacks, Planer
Armstrong Bros. Tool Co.....84

Jigs and Fixtures
Columbus Die, Tool & Mach. Co.....99
Grant Mfg. & Machine Co....124
Taft-Peirce Mfg. Co.....132

Kettles, Soda
Brown & Sharpe Mfg. Co..55, 136
Manufacturing Equipment and Engineering Co.....101

Key Seaters
Baker Bros.....129
Lapointe Co., J. N.....110
Lapointe Mach. Tool Co.....82

Key Seaters—*Continued.*
Marshall & Huschart Machry. Co.....131
Mitts & Merrill.....114
Morton Manufacturing Co....96
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Rockford Drilling Mach. Co..132

Keys, Machine
Morse Twist Drill & Mach. Co. 59
Standard Gauge Steel Co.....112
Whitney Mfg. Co., The.....53

Knives, Machine
Coes Wrench Co.....32
Simonds Mfg. Co.....93

Knurl Holder
Graham Mfg. Co.....105
Pratt & Whitney Co.....47

Lamps, Arc
General Electric Co.....122
Westinghouse Elec. & Mfg. Co.123

Lathe Attachments
American Tool Works Co.....8
Bradford Mach. Tool Co.....5
Diamond Machine Co.....120
Flather & Co., Inc.....87
LeBlond Mach. Tool Co., R. K., 63, 136
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Rivett Lathe Mfg. Co.....135
Sebastian Lathe Co.....88
Seneca Falls Mfg. Co.....76
Sloan & Chace Mfg. Co.....88

Lathe Dogs
Armstrong Bros. Tool Co....84
Besly & Co., Chas. H.....85
Billings & Spencer Co.....92
Hammacher, Schlemmer & Co. 65
Johnson Jr. & Co., I. H.....89
Pratt & Whitney Co.....47
Springfield Mach. Tool Co....49
Tindel-Morris Co.....93
Western Tool & Mfg. Co.....124
Williams & Co., J. H.....80

Lathe Tools
Western Tool & Mfg. Co.....124

Lathes
Acme Machine Tool Co.....30
American Tool & Machine Co.124
American Tool Works Co.....8
Automatic Machine Co.....61
Barnes Co., W. F. & John.....33
Barnes Drill Co.....98
Blount Co., J. G.....119
Bradford Mach. Tool Co.....5
Bullard Machine Tool Co..70, 71
Carter & Hakes Machine Co..105
Champion Tool Works Co....86
Cincinnati Lathe & Tool Co..88
Detrick & Harvey Mach. Co..73
Diamond Machine Co.....120
Dreses Machine Tool Co.....22
Fitchburg Machine Works....35
Flather & Co., Inc.....87
Flather Mfg. Co., E. J.....105
Gisholt Machine Co.....86
Greaves, Klusman & Co.....86
Harrington, Son & Co., Edwin. 91
Hendey Machine Co.....61
Johnson Jr. & Co., I. H.....89
LeBlond Mach. Tool Co., R. K., 63, 136
Lodge & Shipley Mach. Tool Co.....14, 15
Manning, Maxwell & Moore...129
Marshall & Huschart Machry. Co.....131
McCabe, J. J.....89, 130
Milwaukee Mach. Tool Co....86
Morris Mach. Tool Co., J. B.112
Motch & Merryweather Mchry. Co.....130
New Haven Mfg. Co.....87
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Prentice Bros. Co.....29
Prentiss Tool & Supply Co...130
Reed Co., F. E.....44
Rockford Drilling Mach. Co..132
Schumacher & Boye.....22
Sebastian Lathe Co.....88
Sellers & Co., Wm.....38
Seneca Falls Mfg. Co.....76
Springfield Mach. Tool Co....49
Tindel-Morris Co.....93
Toomey, Frank.....129, 131
Vandyck Churchill Co.....93
Von Wyck Mach. Tool Co....88
Wells & Son Co., F. E.....119
Windsor Machine Co.....45
Wormer Mchry. Co., C. C....131

Lathes, Automatic Screw Threading
Automatic Machine Co.....61
Pratt & Whitney Co.....47
Prentiss Tool & Supply Co...130

Lathes, Bench
Ames Co., B. C.....86
Blount Co., J. G.....119
Diamond Machine Co.....120

Lathes, Bench—*Continued.*
Pratt & Whitney Co.....47
Rivett Lathe Mfg. Co.....135
Sebastian Lathe Co.....88
Seneca Falls Mfg. Co.....76
Sloan & Chace Mfg. Co.....88
Stark Tool Co.....86
Taylor & Fenn Co.....97
Waltham Machine Works.....86
Waltham Watch Tool Co.....101
Wells & Son Co., F. E.....119

Lathes, Boring
Harrington, Son & Co., Edwin. 91
Johnson Jr. & Co., I. H.....89
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Inc., Wm.....38

Lathes, Brass
Acme Machine Tool Co.....30
Dreses Mach. Tool Co.....22
Johnson Jr. & Co., I. H.....89
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Springfield Mach. Tool Co....49
Warner & Swasey Co.....39

Lathes, Chucking
Jones & Lamson Machine Co., 12, 13, 50
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47

Lathes, Extension
Barnes Drill Co.....98
Harrington, Son & Co., Edwin. 91
Johnson Jr. & Co., I. H.....89
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130

Lathes, Foot Power
Barnes Co., W. F. & John....33
Niles-Bement-Pond Co....2, 3, 46
Sebastian Lathe Co.....88
Seneca Falls Mfg. Co.....76

Lathes, Gap
American Tool Wks. Co.....8
Barnes Drill Co.....98
Harrington, Son & Co., Edwin. 91
Prentiss Tool & Supply Co...130
Sebastian Lathe Co.....88
Sellers & Co., Wm.....38

Lathes, Horizontal Turret
Flather & Co., Inc.....87
Garvin Machine Co.....75, 94
Gisholt Machine Co.....86
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Prentiss Tool & Supply Co...130
Warner & Swasey Co.....39
Washburn Shops.....118

Lathes, Speed
Blount Co., J. G.....119
Grant Mfg. & Mach. Co.....124
Diamond Machine Co.....120
LeBlond Mach. Tool Co., R. K., 63, 136
Marshall & Huschart Machry. Co.....131
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co.....47
Prentiss Tool & Supply Co...130
Sebastian Lathe Co.....88
Seneca Falls Mfg. Co.....76
Wells & Son Co., F. E.....119

Lathes, Vertical Turret
Bullard Machine Tool Co..70, 71

Lathes, Wood
Barnes Co., W. F. & John....33
Seneca Falls Mfg. Co.....76

Levels
Starrett Co., L. S.....72

Lockers, Clothes
Hart & Cooley Co.....75
Manufacturing Equipment and Engineering Co.....101

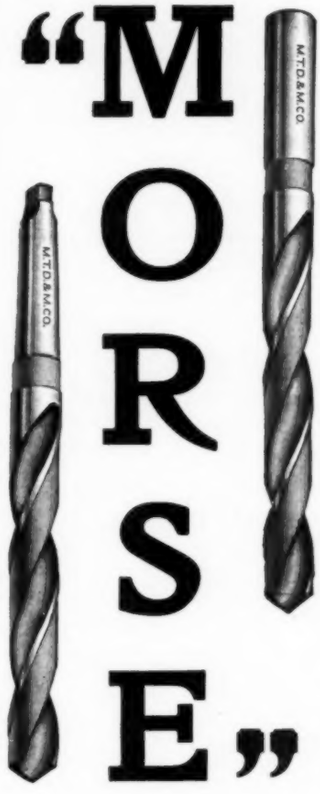
Lubricants
Besly & Co., Chas. H.....85
Dixon Crucible Co., Jos.....112

Lubricators
Besly & Co., Chas. H.....85
Gem Mfg. Co.....119
Greene, Tweed & Co.....96
White & Bagley Co.....116

Machinery Dealers
Besly & Co., Chas. H.....85
Garvin Machine Co.....75, 94
Manning, Maxwell & Moore...129
Marshall & Huschart Mchry. Co.....131
McCabe, J. J.....89, 130
Motch & Merryweather Co....130
Niles-Bement-Pond Co....2, 3, 46
Osgood, J. L.....92
Prentiss Tool & Supply Co...130
Schuchardt & Schütte..17, 28, 96
Toomey, Frank.....129, 131
Vandyck Churchill Co.....93
Wormer Mchry. Co., C. C....131

Machinists' Small Tools
Athol Machine Co.....128
Bemis & Call Hardware and Tool Co.....92

"MORSE"



Twist Drills, Reamers, Milling Cutters, Taps, Etc.

Every time you use a "Morse" Tool it is a satisfactory step towards the successful finish of a job.

Morse Twist Drill & Machine Co.
New Bedford, Mass.

"MORSE"

BLISS

FOR LASTING EFFICIENCY

BLISS INCLINABLE PRESSES

BLISS

"BLISS" INCLINABLE PRESS
No. 21

They are adapted for nearly all the operations required in the manufacture of tin cans, pieced tinware, metal packages, electrical goods, brass goods, trimmings, etc.

Frame—The design combines greatest strength and rigidity with convenience for handling dies and material. It can be quickly adjusted from upright to inclined position.

Slide—The slides fitted with positive knock-outs are long and well gibbed.

Connection—The connections permit of rapid and accurate adjustments, have long adjustments and they stay where set.

Shaft—The shafts are forged steel and of ample proportions to stand the heaviest strain without springing.

Clutch—The "Bliss" positive clutch, a powerful and simple clutch, is furnished.

Fly-Wheel—The Fly-wheels are of large diameter, bronze bushed and fitted with two locking points.

Adjustments—All adjustments are simple, accurate and convenient.

18 sizes, all in stock—Send for Catologue No. 1-A describing them, stating requirements.

"We Build Presses for Every Purpose"

Kataloge und Korrespondenz in deutscher, englischer oder französischer Sprache.

E. W. BLISS COMPANY, 1 Adams Street, Brooklyn, N. Y., U. S. A.

Representatives for Chicago and vicinity: Stiles-Morse Company, No. 562 Washington Boulevard, Chicago, Ill.
European Office: 100 Boulevard Victor Hugo, St. Ouen (Paris), France. London Office: 114 Queen Victoria St., London, E. C., England.

Machinists' Small Tools —*Continued.*
Besly & Co., Chas. H..... 85
Billings & Spencer Co..... 92
Boker & Co., Hermann..... 77
Brown & Sharpe Mfg. Co..55, 136
Cleveland Twist Drill Co.....136
Garvin Machine Co.....75, 94
Hammacher, Schlemmer & Co. 65
Millers Falls Co..... 93
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Schuchardt & Schütte..17, 28, 96
Slocomb Co., J. T..... 98
Standard Tool Co..... 26
Starrett Co., L. S..... 72
Whitman & Barnes Mfg. Co... 97
Williams & Co., J. H..... 80

Machinists' Supplies
Bemis & Call Hardware & Tool Co. 92
Besly & Co., Chas. H..... 85
Garvin Machine Co.....75, 94
Hammacher, Schlemmer & Co. 65
McCabe, J. J.....89, 130
Osgood, J. I..... 92
Schuchardt & Schütte..17, 28, 96
Whitman & Barnes Mfg. Co.. 97

Magnets, Lift
Electric Controller & Supply Co. 125

Mandrels, Expanding
Celfor Tool Co..... 98
Morse Twist Drill & Mach. Co. 59
Nicholson & Co., W. H..... 95
Pratt & Whitney Co..... 47
Western Tool & Mfg. Co.....124
Whitman & Barnes Mfg. Co.. 97

Mandrels, Solid
Brown & Sharpe Mfg. Co..55, 136
Cleveland Twist Drill Co.... 136
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Standard Tool Co..... 26

Measuring Machines
Pratt & Whitney Co..... 47

Metal, Bearings
Atkinson Co. 110
Besly & Co., Chas. H..... 85
Lumen Bearing Co.....111

Micrometer Calipers
Brown & Sharpe Mfg. Co..55, 136
Slocomb Co., J. T..... 98
Starrett Co., L. S..... 72

Milling Attachments
Adams Co.....104
Becker Milling Machine Co... 23
Brown & Sharpe Mfg. Co..55, 136
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....75, 94
Ingersoll Milling Mach. Co.... 4
Kearney & Trecker Co..... 26
Kempsmith Mfg. Co..... 27
LeBlond Mach. Tool Co., R. K., 63, 136
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....135
Whitney Mfg. Co..... 53

Milling Machines, Bench
Ames Co., B. C..... 86
Carter & Hakes Machine Co..105
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....135
Sloan & Chace Mfg. Co..... 88
Stark Tool Co..... 86
Waltham Watch Tool Co.....101

Milling Machines, Hand
Adams Co.....104
Becker Milling Machine Co... 23
Brown & Sharpe Mfg. Co..55, 136
Carter & Hakes Machine Co. 105
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....75, 94
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Whitney Mfg. Co..... 53

Milling Machines, Horizontal
Adams Co.....104
Beaman & Smith Co.....25, 94
Becker Milling Machine Co... 23
Brown & Sharpe Mfg. Co..55, 136
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....75, 94
Hendey Machine Co..... 61
Ingersoll Milling Mach. Co... 4
Kempsmith Mfg. Co..... 27
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Rochester Boring Machine Co.124
Sellers & Co., Wm..... 38
Universal Boring Machine Co. 92
Whitney Mfg. Co..... 53

Milling Machines, Plain
Adams Co.....104
American Tool Works Co.... 8
Beaman & Smith Co.....25, 9
Becker Milling Machine Co... 23
Brown & Sharpe Mfg. Co..55, 136
Carter & Hakes Mach. Co.... 105
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....75, 94
Hendey Machine Co..... 61
Ingersoll Milling Mach. Co... 4
Kearney & Trecker Co..... 26
Kempsmith Mfg. Co..... 27
LeBlond Mach. Tool Co., R. K., 63, 136
Manning, Maxwell & Moore...129
Marshall & Huschart Machry. Co. 131
McCabe, J. J.....89, 130
Morton Mfg. Co..... 96
Motch & Merryweather Machinery Co.....130
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Vandyck Churchill Co..... 93
Waltham Watch Tool Co.....101
Warner & Swasey Co..... 39
Whitney Mfg. Co..... 53
Wormer Mchry. Co., C. C....131

Milling Machines, Portable
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46

Milling Machines, Universal
American Tool Wks. Co..... 8
Becker Milling Machine Co... 23
Brown & Sharpe Mfg. Co..55, 136
Cincinnati Milling Mach. Co..6, 7
Garvin Machine Co.....75, 94
Hendey Machine Co..... 61
Kearney & Trecker Co..... 26
Kempsmith Mfg. Co..... 27
LeBlond Mach. Tool Co., R. K., 63, 136
Manning, Maxwell & Moore...129
Marshall & Huschart Machine Co. 131
McCabe, J. J.....89, 130
Motch & Merryweather Machinery Co.....130
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Waltham Watch Tool Co.....101

Milling Machines, Vertical
Adams Co.....104
Barber-Colman Co..... 37
Beaman & Smith Co.....25, 94
Becker Milling Machine Co... 23
Brown & Sharpe Mfg. Co..55, 136
Carter & Hakes Machine Co..105
Cincinnati Milling Mach. Co..6, 7
Clough, R. M..... 99
Garvin Machine Co.....75, 94
Ingersoll Milling Mach. Co... 4
Marshall & Huschart Machry. Co. 131
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Sellers & Co., Wm..... 38
Vandyck Churchill Co..... 93
Waltham Watch Tool Co.....101

Milling Machines, Worm
Cleveland Auto. Mach. Co.... 18
Pratt & Whitney Co..... 47

Milling Tools, Adjustable
Geometric Tool Co..... 42
Grant Mfg. & Machine Co....124

Mining Machinery
Ingersoll-Rand Co.....117
Sullivan Machinery Co.....117

Molding Machines
Adams Co.....104
Tabor Mfg. Co.....113

Motors, Electric
Burke Electric Co.....124
Coates Clipper Mfg. Co..... 129
General Electric Co.....122
Holtzer-Cabot Electric Co....124
Reliance Elec. & Eng. Co....124
Richmond Electric Co.....124
Roth Bros. & Co.....124
Sprague Electric Works.....123
Triumph Electric Co.....123
Westinghouse Elec. & Mfg. Co.123

Name Plates
Franklin Mfg. Co.....110

Nippers and Pliers
Utica Drop Forge & Tool Co.. 84

Nut Tappers
See Bolt and Nut Machinery.

Nuts
Milton Mfg. Co..... 67

Odometers
Veeder Mfg. Co.....101

Oil Cups and Covers
Bay State Stamping Co..... 89
Besly & Co., Chas. H..... 85
Doehler Die Casting Co.....107

Oilers
Gem Mfg. Co.....119

Oils
Besly & Co., Chas. H..... 85
White & Bagley Co.....119

Packing, Hydraulic
Chicago Rawhide Mfg. Co....104

Packing, Steam
Greene, Tweed & Co..... 96
Smooth-On Mfg. Co.....111

Paints, Machinery
Glidden Varnish Co..... 108

Pans, Lathe Shop
New Britain Machine Co..... 84

Pattern Shop Tools and Machinery
Baker Bros. 129
Blount Co., J. G.....119
Colburn Machine Tool Co.... 81
Greaves, Klusman & Co..... 86
Hammacher, Schlemmer & Co. 65
McCabe, J. J.....89, 130
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Rowbottom Machine Co.....118
Seneca Falls Mfg. Co..... 76

Phosphor Bronze
Lumen Bearing Co.....111

Pin Machinery
Baird Machine Co., The.....121

Pinion Cutters
Sloan & Chace Mfg. Co..... 88
Stark Tool Co..... 86

Pipe Bending Machines
Chicago Pneumatic Tool Co..116
Treadwell Engine Co.....127

Pipe Cutting and Threading Machines
Bignall & Keeler Mfg. Co.....127
Curtis & Curtis Co.....127
Foote-Burt Co..... 99
Landis Machine Co.....100
Niles-Bement-Pond Co....2, 3, 46
Saunders' Sons, D.....127
Standard Engineering Wks...127
Treadwell Engine Co.....127
United Engineering & Fdry. Co.121
Wiley & Russell Mfg. Co.....100

Pipe Fitters' Tools
Butterfield & Co.....100
Cleveland Twist Drill Co....136
Reed Mfg. Co.....105
Saunders' Sons, D.....127
Standard Tool Co..... 26
Trimont Mfg. Co..... 85
Wells & Son Co., F. E.....119
Williams & Co., J. H..... 80

Pipe, Welded and Seamless
National Tube Co.....111

Planer Attachments
Cincinnati Planer Co..... 16
Gray Co., G. A..... 28
Niles-Bement-Pond Co....2, 3, 46
Reed Co., F. E..... 44

Planer Tools
Armstrong Bros. Tool Co..... 84

Planers
American Tool Works Co.... 8
Betts Machine Co..... 9
Cincinnati Planer Co..... 16
Cleveland Planer Works..... 81
Detrick & Harvey Mach. Co.. 73
Fitchburg Machine Works.... 35
Gray Co., G. A..... 28
Harrington, Son & Co., Edwin. 91
Hendey Machine Co..... 61
Manning, Maxwell & Moore...129
McCabe, J. J.....89, 130
Motch & Merryweather Machy. Co. 130
New Haven Mfg. Co..... 87
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Sellers & Co., Wm..... 38
Toomey, Frank 129, 131
Vandyck Churchill Co..... 93
Woodward & Powell Planer Co.115
Wormer Mchry. Co., C. C....131

Planers, Parallel
Walker & Co., O. S.....136

Planers, Portable
Morton Manufacturing Co.... 96
Niles-Bement-Pond Co....2, 3, 46

Planers, Rotary
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Tindel-Morris Co..... 93

Plate Rolls
Niles-Bement-Pond Co....2, 3, 46
Taylor-Wilson Mfg. Co.....104

Precision Machinery
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....135
Sloan & Chace Mfg. Co..... 88
Stark Tool Co..... 86
Waltham Watch Tool Co.....101

Presses, Arch
Blake & Johnson Co.....120

Presses, Bench Straightening
Springfield Machine Tool Co.. 49

Presses, Broaching
Bliss Co., E. W..... 59
Watson-Stillman Co..... 77

Presses, Drop
Bliss Co., E. W..... 59
Niles-Bement-Pond Co....2, 3, 46
Toledo Machine & Tool Co...121
Waterbury Farrel Fdry. and Mach. Co..... 50

Presses, Foot and Hand
Bliss Co., E. W..... 59
Ferracute Machine Co.....121
La Salle Machine Tool Co....118
Taylor & Fenn Co..... 97
Waterbury Farrel Fdry. and Mach. Co..... 50

Presses, Forging
Bliss Co., E. W..... 59
Niles-Bement-Pond Co....2, 3, 46
United Engineering & Fdry. Co.121

Presses, Hydraulic
Elmes Eng. Wks., Chas. F....121
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
United Eng. & Fdry. Co.....121
Waterbury Farrel Fdry. and Mach. Co..... 50
Watson-Stillman Co..... 77

Presses, Pneumatic
Springfield Machine Tool Co.. 49

Presses, Power
Automatic Machine Co..... 61
Baird Machine Co., The.....121
Billings & Spencer Co..... 92
Blake & Johnson Co.....120
Bliss Co., E. W..... 59
Dill Slotter People.....115
Ferracute Machine Co.....121
La Salle Machine Tool Co....118
McCabe, J. J.....89, 130
Niagara Machine & Tool Wks.121
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Springfield Machine Tool Co.. 49
Toledo Machine & Tool Co....121
United Engineering & Fdry. Co.121
Vandyck Churchill Co..... 93
Waterbury Farrel Fdry. and Mach. Co..... 50

Presses, Power Forcing
Barnes Co., W. F. & John.... 33
Lucas Machine Tool Co.....115

Presses, Screw
Barnes Co., W. F. & John.... 33
Bliss Co., E. W..... 59

Presses, Sub
Blake & Johnson Co.....120

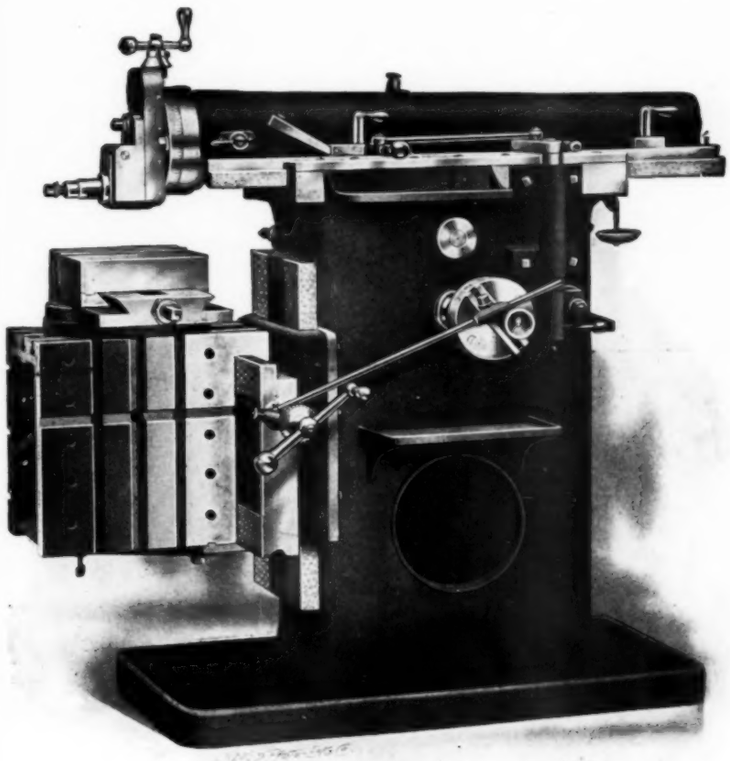
Profilers
Becker Milling Machine Co... 23
Garvin Machine Co.....75, 94
Newton Machine Tool Wks... 19
Pratt & Whitney Co..... 47
Stark Tool Co..... 86

Pulley Turning and Boring Machines
American Tool Wks. Co..... 8
Harrington, Son & Co., Edwin. 91
New Haven Mfg. Co..... 87
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46

Pulleys
American Pulley Co..... 91
American Tool & Machine Co.124
Brown, A. & F.....104
Brown & Sharpe Mfg. Co..55, 136
Caldwell & Sons Co., H. W....128
Link-Belt Co. 1, 79
New Haven Mfg. Co..... 87
Niles-Bement-Pond Co....2, 3, 46
Oneida Steel Pulley Co..... 91
Rockwood Mfg. Co..... 90
Sellers & Co., Wm..... 38
Taylor-Wilson Mfg. Co.....104
Wilmarth & Morman Co.....120

Pulleys, Paper
Rockwood Mfg. Co..... 90

Pumps, Electric
General Electric Co.....122



THE shaper is a tool used intermittently for odd operations—likely to be run by several different men during the day. Under such conditions the stroke is frequently changed, table raised or lowered, and the ratio of the feed altered. A shaper in which all of these features can be handled easily and quickly is one the men go to in preference to the others and this one is apt to be a Hendey. Write for information showing how it differs from other shapers.

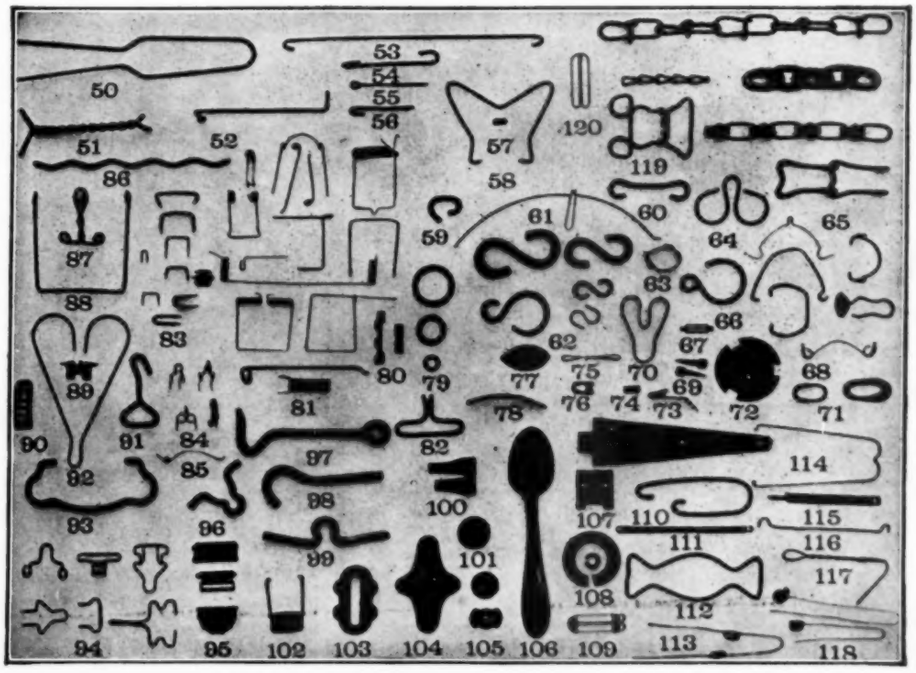
The Hendey Machine Co.
Torrington, Conn., U. S. A.

Or the following UNITED STATES AGENTS: Manning, Maxwell & Moore, New York, Buffalo, Boston, Pittsburg, Chicago, Philadelphia, Detroit, Atlanta, Seattle, Wash., Mexico and Japan; J. L. Osgood, Buffalo; Pacific Tool and Supply Co., San Francisco, Cal.; W. M. Pattison Machinery Co., Cleveland, Ohio; J. W. Wright & Co., St. Louis; R. V. Whitacre & Co., St. Paul; Strong-Carlisle-Hammond Co., Detroit; A. R. Williams Machinery Co., Toronto.

EUROPEAN AGENTS: Schuchardt & Schutte, Berlin, Vienna, Stockholm, St. Petersburg, Copenhagen and Budapest. A. H. Schutte, Koln, Paris, Brussels, Bilbao, Milano; Chas. Churchill & Co., Ltd., London, Birmingham.

"The Automatic" Machines Do Work Like This

If you want to turn out such work as this at the fastest speed and at the lowest cost, then investigate our line of special automatic machinery. If you will send us samples or blueprints of your work we'll estimate the cost of same as done by *our* machines. The figures will surprise you.



50 Wire handle. 51 Twist wire. 52 Special. 53 Links. 54 Links. 55 Screw eye blank. 56 Screw eye blank. 57 Side for bicycle chain link. 58 Special. 59 Dredge link. 60 Link. 61 Neck wire. 62 S. hooks. 63 Hose clamp. 64 Finger ring. 65 Chain. 66 Chain hook. 67 Buckle. 68 Bottle wires. 69 Button fastener. 70 Wire shape. 71 Repair links. 72 Sheet blank. 73 Trap wire. 74 Umbrella spring. 75 Fish line swivel. 76 Corset fasteners. 77 Fish hook spoon. 78 Spring. 79 Flat and round rings. 80 Umbrella clamp. 81 Mouse and rat trap wires. 82 Belt Hook. 83 Staples. 84 Hooks and eyes. 85 Piano wires. 86 Crimped wire. 87 Hook. 88 Trap wire. 89 Eyelet. 90 Shoe fastener. 91 Hook. 92 Special. 93 Drawer or chest handle. 94 Suspender and trouser buckles. 95 Suspender buckle plates. 96 Bottle wire. 97 Iron hook. 98 Blank hammock hook. 99 T bar. 100 File wire holder. 101 Button back. 102 Bottle cap. 103 Sheet metal form. 104 Portier pole bracket. 105 Curtain pole plates. 106 Spoon. 107 Hinges. 108 Check washers. 109 Hose supporter. 110 Tie wire. 111 Seal wire. 112 Special shape. 113 Neck wire. 114 Gas mantle wire. 115 Harness wire. 116 Link. 117 Bag tie. 118 Car seals and wires. 119 Belt Hook.

Automatic Machine Co.,
Bridgeport, Conn., U. S. A.

Pumps, Hydraulic
Elmes Eng. Works, Chas. F...121
General Electric Co.....122
Watson-Stillman Co..... 77

Pumps, Pneumatic Steam
Clayton Air Compressor Wks. 117
Ingersoll-Rand Co..... 117

Punches, Centering
Brown & Sharpe Mfg. Co..55, 136
Hammacher, Schlemmer & Co. 65
Sellers & Co., Wm..... 38
Starrett Co., L. S..... 72

Punches, Hand
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38

Punches, Hydraulic
Elmes Eng. Works, Chas. F...121
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co....130
Sellers & Co., Wm..... 38
United Eng. & Fdry. Co.....121
Watson-Stillman Co..... 77

Punches, Power
Armstrong-Blum Mfg. Co..... 93
Bliss Co., E. W..... 59
Covington Machine Co.....126
Ferracute Machine Co.....121
Hilles & Jones Co.....126
Long & Allstatter Co.....126
McCabe, J. J.....89, 130
Mitts & Merrill.....114
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
United Eng. & Fdry. Co.....121

Pyrometers, Electric
Bristol Co.....136
Brown Instrument Co..... 101
Hoskins Mfg. Co.....115

Rack Cutting Machines
Adams Co.....104
Fellows Gear Shaper Co..... 24
Flather Mfg. Co., E. J.....105
Gould & Eberhardt..... 31
Horsburgh & Scott Co.....105
LeBlond Mach. Tool Co., R. K., 63, 136
Niles-Bement-Pond Co....2, 3, 46
Reed Co., F. E..... 44
Schuchardt & Schütte..17, 28, 96
Sloan & Chace Mfg. Co..... 88

Racks, Cut
Boston Gear Works.....102
Brown & Sharpe Mfg. Co..55, 136
Fellows Gear Shaper Co..... 24
Flather Mfg. Co., E. J.....105
Horsburgh & Scott Co.....105
LeBlond Mach. Tool Co., R. K., 63, 136
Newark Gear Cutting Machine Co.....104
Nuttall Co., R. D.....102
Philadelphia Gear Works.....102
Simonds Mfg. Co., The.....102
Standard Gauge Steel Co.....112
Taylor-Wilson Mfg. Co.....104

Racks, Tool
Manufacturing Equipment and Engineering Co.....101
New Britain Mach. Co..... 84

Radiators, Japanning Oven
American Gas Furnace Co....108

Rawhide
Colonial Leather Co.....102

Reamer Holders, Floating
Colburn Machine Tool Co.... 81

Reamers
Boker & Co., Hermann..... 77
Butterfield & Co.....100
Card Mfg. Co., S. W.....40, 41
Carpenter Tap & Die Co., J. M.100
Cleveland Twist Drill Co....136
Clough, R. M..... 99
Detroit Twist Drill Co..... 97
Gisholt Machine Co..... 86
Lapointe Mach. Tool Co..... 82
Lincoln-Williams Twist Drill Co..... 99
Morse Twist Drill & Mach. Co. 59
Pratt & Whitney Co..... 47
Standard Tool Co..... 26
Ward & Son, Edgar T.....113
Western Tool & Mfg. Co.....124
Whitman & Barnes Mfg. Co.. 97
Wiley & Russell Mfg. Co.....100

Reamers, Expanding
Pratt & Whitney Co..... 47

Reaming Stands
Skinner Chuck Co..... 96

Recorders, Time
Calculagraph Co.....101

Rheostats
Electric Controller & Supply Co.....125
General Electric Co.....122
Westinghouse Elec. & Mfg. Co.123

Rivet Making Machinery
Blake & Johnson Co.....120
National Machinery Co.....126

Riveters, Hydraulic
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38

Riveters, Pneumatic
Bliss Co., E. W..... 59
Chicago Pneumatic Tool Co..116
Dallett Co., Thos. H.....117
Independent Pneu. Tool Co...117
Ingersoll-Rand Co.....117
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Shepard Electric Crane & Hoist Co..... 92

Riveters, Steam
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38

Riveting Machines
Adt & Son, John.....126
Grant Mfg. & Mach. Co.....124
Hemming Bros. Co.....126
Long & Allstatter Co.....126
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Shuster Co., F. B.....126
Townsend Mfg. Co., H. P.....126

Rolling Mill Machinery
Blake & Johnson Co.....120
Dill Slotter People.....115
Hilles & Jones Co.....126
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
United Eng. & Fdry. Co.....121
Waterbury Farrel Fdry. and Mach. Co..... 50

Rules, Steel
Brown & Sharpe Mfg. Co..55, 136
Dill Slotter People.....115
Hammacher, Schlemmer & Co. 65
Slocomb Co., J. T..... 98
Starrett Co., L. S..... 72

Sand Blast Apparatus
Chicago Pneumatic Tool Co...116
Pangborn Co., Thos. W.....117
Paxson Co., J. W.....117

Sand Shifting Machinery
LinkBelt Co. 1, 79

Saw Frames and Blades, Hack
Hammacher, Schlemmer & Co. 65
Millers Falls Co..... 93
Niles-Bement-Pond Co....2, 3, 46
Simonds Mfg. Co..... 93
Starrett Co., L. S..... 72
Thompson & Son Co., Henry G. 93
West Haven Mfg. Co..... 93

Saw Sharpening Machines
Newton Machine Tool Wks... 19

Sawing Machines
Frontier Iron Works..... 99

Sawing Machines, Metal
Billings & Spencer Co..... 92
Gorton Machine Co., Geo....112
Hoefer Mfg. Co..... 69
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Simonds Mfg. Co..... 93
Tabor Mfg. Co.....113
Tindel-Morris Co..... 93
Union Twist Drill Co..... 67
United Eng. & Fdry. Co.....121
Vandyck Churchill Co..... 93
West Haven Mfg. Co..... 93

Sawing Machines, Wood
Colburn Machine Tool Co.... 81
Greaves, Klusman & Co..... 86
Seneca Falls Mfg. Co..... 76

Saws, Circular Metal
Simonds Mfg. Co..... 93

Saws, Metal Band
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co....130
Simonds Mfg. Co..... 93
West Haven Mfg. Co..... 93

Saws, Power Hack
Armstrong-Blum Mfg. Co..... 93
Frontier Iron Works..... 99
Hoefer Mfg. Co..... 69
Massachusetts Saw Works.... 93
Millers Falls Co..... 93
Niles-Bement-Pond Co....2, 3, 46
Simplex Mfg. Co..... 93
Thompson & Son Co., Henry G. 93
West Haven Mfg. Co..... 93
Western Tool & Mfg. Co.....124

Saws, Screw Slotting
Simonds Mfg. Co..... 93

Scales
Brown & Sharpe Mfg. Co..55, 136

Scleroscope
Shore Instrument & Mfg. Co..113

Scraper Holders
Western Tool & Mfg. Co.....124

Scrapers, Universal
Western Tool & Mfg. Co.....124

Screens, Shaking
Link-Belt Co. 1, 79

Screw Machine Work
National-Acme Mfg. Co.....134
Rummel Machine Screw Co...128

Screw Machinery, Wood and Lag
Baker Bros. 129
Cook Co., Asa S.....127

Screw Machines, Automatic
Brown & Sharpe Mfg. Co..55, 136
Cleveland Automatic Mach. Co. 18
Davenport Machine Tool Co..128
Dreses Mach. Tool Co..... 22
Johnson Jr. & Co., I. H..... 89
Marshall & Huschart Machry. Co.....131
National-Acme Mfg. Co.....134
New Britain Machine Co..... 84
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Universal Machine Screw Co.127
Windsor Machine Co..... 45

Screw Machines, Hand
Acme Machine Tool Co..... 30
Brown & Sharpe Mfg. Co..55, 136
Cleveland Automatic Mach. Co. 18
Garvin Machine Co.....75, 94
Grant Mfg. & Mach. Co.....124
Jones & Lamson Mach. Co., 12, 13, 50
Potter & Johnston.....20, 21
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Rivett Lathe Mfg. Co.....135
Warner & Swasey Co..... 39
Wells & Son Co., F. E.....119
Windsor Machine Co..... 45

Screw Plates
American Tap & Die Co..... 99
Besly & Co., Chas. H..... 85
Butterfield & Co.....100
Card Mfg. Co., S. W.....40, 41
Carpenter Tap & Die Co., J. M.100
Holroyd & Co..... 99
Morse Twist Drill & Mach. Co. 59
Smart Mfg. Co., A. J.....100
Wells Bros. Co.....100
Wiley & Russell Mfg. Co.....100

Screws, Cap and Set
Allen Mfg. Co., Inc., The....128
Electric Welding Products Co.110
Hammacher, Schlemmer & Co. 65
National-Acme Mfg. Co.....134
Universal Machine Screw Co.127
Worcester Mach. Screw Co...127

Screws, Machine
Allen Mfg. Co., Inc., The....128
Barnes Co., Wallace.....128
Electric Welding Products Co 110
Hammacher, Schlemmer & Co. 65
National-Acme Mfg. Co.....134
Standard Gauge Steel Co.....112
Universal Machine Screw Co.127
Worcester Machine Screw Co.127

Second Hand Machinery
Garvin Machine Co.....75, 94
Manning, Maxwell & Moore..129
Marshall & Huschart Machry. Co.....131
McCabe, J. J.....89, 130
Motch & Merryweather Machy. Co.....130
Nast Machinery Co., D.....131
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Seneca Falls Mfg. Co..... 76
Toomey, Frank 129, 131
Wormer Machry. Co., C. C....131

Separators, Oil and Steam
American Tool & Machine Co.124
Nicholson & Co., W. H..... 75

Shafting
Ward & Sons, Edgar T.....113

Shafting Alining Apparatus
Kinkead Mfg. Co..... 84

Shapers
American Tool Works Co..... 8
Cincinnati Shaper Co..... 48
Fitchburg Machine Works.... 35
Gould & Eberhardt..... 31
Hendey Machine Co..... 61
Kelly Co., R. A..... 88
Manning, Maxwell & Moore...129
Marshall & Huschart Machry. Co.....131
McCabe, J. J.....89, 130
Morton Manufacturing Co.... 96
Motch & Merryweather Machinery Co.....130
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46

Shapers—*Continued.*
Potter & Johnston.....20, 21
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co....130
Sellers & Co., Wm..... 38
Smith & Mills..... 89
Springfield Mach. Tool Co.... 49
Vandyck Churchill Co..... 93

Shears, Power
Bliss Co., E. W..... 59
Covington Machine Co.....126
Ferracute Machine Co.....121
Hilles & Jones Co.....126
Long & Allstatter Co.....126
Mitts & Merrill.....114
Niagara Mach. & Tool Wks...121
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Toledo Mach. & Tool Co.....121
United Eng. & Fdry. Co.....121

Shears, Rotary
Bliss Co., E. W..... 59
Detrick & Harvey Mach. Co.. 73
United Eng. & Fdry. Co.....121

Sheet Metal Working Machinery
Bliss Co., E. W..... 59
Ferracute Machine Co.....121
La Salle Machine Tool Co....118
Niagara Mach. & Tool Wks...121
Toledo Mach. & Tool Co.....121
Waterbury Farrel Fdry. and Mach. Co..... 50

Slide Rests
Betts Machine Co..... 9
Blount Co., J. G.....119
Grant Mfg. & Mach. Co.....124
National-Acme Mfg. Co.....134
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Reed Co., F. E..... 44

Slitters
Blake & Johnson Co.....120
La Salle Machine Tool Co....118

Slotters
Baker Bros.....129
Betts Machine Co..... 9
Dill Slotter People.....115
Garvin Machine Co.....75, 94
McCabe, J. J.....89, 130
New Haven Mfg. Co..... 87
Newton Machine Tool Wks... 19
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Tindel-Morris Co..... 93

Slotters, Auto Screw
Brown & Sharpe Mfg. Co..55, 136
Taylor & Fenn Co..... 97

Slotters, Portable
Newton Machine Tool Wks... 19

Sockets and Sleeves
Celfor Tool Co..... 98
Cleveland Twist Drill Co....136
Morse Twist Drill & Mach. Co. 59
Standard Tool Co..... 26
Union Twist Drill Co..... 67
Whitman & Barnes Mfg. Co.. 97

Special Machinery and Tools
Automatic Machine Co..... 61
Baird Machine Co., The.....121
Beaman & Smith Co.....25, 94
Bilgram Machine Works.....105
Blanchard Machine Co....76, 101
Bliss Co., E. W..... 59
Carter & Hakes Mach. Co....105
Cowdrey Mach. Wks., C. H...127
Dallett, Thos. H.....117
Detroit Twist Drill Co..... 97
Earle Gear & Machine Co....104
Electric Welding Products Co. 110
Garvin Machine Co.....75, 94
Grant Mfg. & Machine Co.....124
Hoefer Mfg. Co..... 69
Hoggson & Pettis Mfg. Co.... 95
Horton Machine Co., S. E.... 94
Johnson Jr. & Co., I. H..... 89
Lucas Machine Tool Co.....115
Manning, Maxwell & Moore...129
Merritt, Jos..... 50
Morrow Mfg. Co..... 95
Mueller Mach. Tool Co..... 98
National Machinery Co.....126
Nazel Engr. & Machine Wks...121
Niles-Bement-Pond Co....2, 3, 46
Poole Engr. & Machine Co....104
Pratt & Whitney Co..... 47
Rowbottom Machine Works..118
Sloan & Chace Mfg. Co..... 88
Standard Engineering Wks...127
Taft-Peirce Mfg. Co.....132
Taylor & Fenn Co..... 97
Taylor-Wilson Co.....104
Weeks, C. S.....105

Spiral Gear Cutting Machines
Pratt & Whitney Co..... 47

Springs
American Vanadium Co.....107
Barnes Co., Wallace.....128
Crucible Steel Co. of America. 109

Three New Catalogs

HOT FROM THE PRESS

Illustrating And Describing Our Line Of

LATHES

MILLING MACHINES

AND

CUTTER GRINDERS

Each Representing The Best There Is In Their Respective Lines As To Design Workmanship And Productive Capacity

We Will Be Pleased To Send Any Or All Of The Above to Interested Parties

---

THE R. K. LE BLOND MACHINE TOOL CO.

4609 EASTERN AVE.

CINCINNATI, OHIO

Sprockets and Chains
Bilgram Machine Works.....105
Boston Gear Works.....102
Brown & Sharpe Mfg. Co..55, 136
Link-Belt Co. 1, 79
Philadelphia Gear Works.....102

Stampings, Sheet Metal
Bay State Stamping Co..... 89

Stamps, Steel
Hoggson & Pettis Mfg. Co.... 95

Stands, Portable
Western Tool & Mfg. Co.....124

Steam Specialties
Dart Mfg. Co., E. M.....100
National Tube Co.....111

Steel, Air Hardening
Boker & Co., Hermann..... 77
Crucible Steel Co. of America..109
Firth-Sterling Steel Co.....106
Hawkridge Brothers Co.....112
Jessop & Sons, Inc., Wm.....109
Vanadium-Alloys Steel Co....111
Vulcan Crucible Steel Co.....110

Steel Hardness Measuring Instruments
Shore Instrument & Mfg. Co.113

Steel, Machinery
Boker & Co., Hermann..... 77
Crucible Steel Co. of America..109
Hawkridge Brothers Co.....112
Jessop & Sons, Inc., Wm.... 109
Standard Gauge Steel Co....112
Union Drawn Steel Co.....108
United Steel Co.....108
Vanadium-Alloys Steel Co....111
Vulcan Crucible Steel Co.....110
Ward & Son, Edgar T.....113

Steel, Sheet
Crucible Steel Co. of America..109
Firth-Sterling Steel Co.....106
Hawkridge Brothers Co.....112
Jessop & Sons, Inc., Wm.....109
Simonds Mfg. Co..... 93
Union Drawn Steel Co.....108
United Steel Co.....108
Vanadium-Alloys Steel Co....111
Vulcan Crucible Steel Co.....110
Ward & Son, Edgar T.....113

Steel, Tool
Boker & Co., Hermann..... 77
Crucible Steel Co. of America..109
Firth-Sterling Steel Co.....106
Hawkridge Brothers Co.....112
Jessop & Sons, Inc., Wm.....109
Standard Gauge Steel Co.....112
Union Drawn Steel Co.....108
Vanadium-Alloys Steel Co....111
Vulcan Crucible Steel Co.....110
Ward & Son, Edgar T.....113
Western Tool & Mfg. Co.....124

Steel, Vanadium
Crucible Steel Co. of America..109
Firth Sterling Steel Co.....106
Hawkridge Brothers Co.....112
United Steel Co.....108
Vanadium-Alloys Steel Co....111
Vulcan Crucible Steel Co.....110

Stocks, Die
See Taps and Dies.

Stones, Oil
American Emery Wheel Wks. 120
Carborundum Co..... 42
Dickinson, Thos. L..... 50
Norton Co..... 69
Vitrified Wheel Co.....118

Stools, Shop
Manufacturing Equipment and Engineering Co.....101
New Britain Machine Co..... 84

Straighteners, Hydraulic
Niles-Bement-Pond Co....2, 3, 46

Straightening Machinery
Morse Twist Drill & Mach. Co. 59
Niles-Bement-Pond Co....2, 3, 46
Sellers & Co., Wm..... 38
Springfield Machine Tool Co.. 49
United Eng. & Fdry. Co.....121

Strip Metal Straightening and Cutting Machine
Shuster Co., F. B.....126

Swaging Machines
Excelsior Needle Co.....127

Switchboards
General Electric Co.....122
Triumph Electric Co.....123
Westinghouse Elec. & Mfg. Co.123

Switches
General Electric Co.....122
Westinghouse Elec. & Mfg. Co.123

Tachometers
Veeder Mfg. Co.....101

Tap Holders
Brown & Sharpe Mfg. Co..55, 136
Errington, F. A..... 95
Modern Tool Co.....118
Warner & Swasey Co..... 39

Tapes, Measuring
Starrett Co., L. S..... 72

Tapping Machines and Attachments
American Tool Works Co..... 8
Baker Bros. 129
Beaman & Smith Co.....25, 94
Cincinnati Bickford Tool Co., 10, 11
Errington, F. A..... 95
Fosdick Mach. Tool Co..... 32
Garvin Machine Co.....75, 94
Geometric Tool Co..... 42
Gould & Eberhardt..... 31
Grant Mfg. & Mach. Co.....124
Modern Tool Co.....118
Niles Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Prentiss Tool & Supply Co...130
Rochester Boring Machine Co.124
Sloan & Chace Mfg. Co..... 88
Wells & Son Co., F. E.....119
Whitney Mfg. Co..... 53

Taps and Dies
American Tap & Die Co..... 99
Bay State Tap & Die Co.....100
Besly & Co., Chas. H..... 85
Boker & Co., Hermann..... 77
Brubaker & Bros., W. L..... 99
Butterfield & Co.....100
Card Mfg. Co., S. W.....40, 41
Carpenter Tap & Die Co., J. M.100
Cleveland Twist Drill Co....136
Curtis & Curtis Co.....127
Foote-Burt Co..... 99
Geometric Tool Co..... 42
Hammacher, Schlemmer & Co. 65
Holroyd & Co..... 99
Modern Tool Co.....118
Morse Twist Drill & Mach. Co. 59
Nicholson & Co., W. H..... 75
Pratt & Whitney Co..... 47
Reed Mfg. Co.....105
Saunders' Sons, D.....127
Smart Mfg. Co., A. J.....100
Standard Tool Co..... 26
Ward & Sons, Edgar T..... 113
Wells & Son Co., F. E.....119
Wells Bros. Co.....100
Whitman & Barnes Mfg. Co.. 97
Wiley & Russell Mfg. Co.....100

Taps, Collapsing
Geometric Tool Co..... 42

Telephones, Intercommunicating
Holtzer-Cabot Electric Co....124

Testing Machines
Sellers & Co., Wm..... 38

Thermometers
Bristol Co.....136
Brown Instrument Co.....101

Thread Cutting Tools
Besly & Co., Chas. H..... 85
Blake & Johnson Co.....120
Foote-Burt Co..... 99
Modern Tool Co.....118
National Machinery Co.....126
Pratt & Whitney Co..... 47
Rivett Lathe Mfg. Co.....135
United Engr. & Fdry. Co.....121
Western Tool & Mfg. Co.....124

Thread Milling Machines
Pratt & Whitney Co..... 47

Thread Rolling Machinery
Waterbury Farrel Fdry. and Mach. Co..... 50

Tool Holders
Armstrong Bros. Tool Co.... 84
Billings & Spencer Co..... 92
Cleveland Twist Drill Co....136
Grant Mfg. & Machine Co....124
Hammacher, Schlemmer & Co. 65
Osgood, J. I..... 92
Pratt & Whitney Co..... 47
Western Tool & Mfg. Co.....124

Tool Racks
Wells & Sons Co., F. E.....119
Western Tool & Mfg. Co.....124

Tools, Small
See Machinists' Small Tools.

Transformers and Converters
Westinghouse Elec. & Mfg. Co.123

Transmission Machinery
American Pulley Co..... 91
Caldwell & Sons Co., H. W....128
Caldwell & Co., Inc., W. E.... 90
Coates Clipper Mfg. Co.....129
Hyatt Roller Bearing Co..... 92
Kinkead Mfg. Co..... 84
Link-Belt Co. 1, 79
Morse Chain Co..... 91
Niles-Bement-Pond Co....2, 3, 46
Oneida Steel Pulley Co..... 91
Poole Engr. & Machine Co....104
Rockwood Mfg. Co..... 90
Sellers & Co., Wm..... 38

Trolley Wheels
Lumen Bearing Co.....111

Trolleys and Tramways
Brown Hoisting Mchry. Co... 93
Harrington, Son & Co., Edwin. 91
Moore Co., Franklin..... 92
Niles-Bement-Pond Co....2, 3, 46
Shepard Elec. Crane & Hoist Co. 92
Yale & Towne Mfg. Co..... 91

Tubing, Seamless Steel
Almond Mfg. Co., T. R..... 94
National Tube Co.....111
Standard Welding Co.....106
Ward & Son, Edgar T.....113

Turntables
Link-Belt Co. 1, 79
Sellers & Co., Wm..... 38

Turret Heads
Almond Mfg. Co., T. R..... 94

Turret Machines
Acme Machine Tool Co..... 30
American Tool & Machine Co.124
Bradford Mach. Tool Co..... 5
Brown & Sharpe Mfg. Co..55, 136
Bullard Machine Tool Co..70, 71
Dreses Mach. Tool Co..... 22
Flather Mfg. Co., E. J.....105
Gisholt Machine Co..... 86
Jones & Lamson Mach. Co., 12, 13, 50
LeBlond Mach. Tool Co., R. K., 63, 136
Lodge & Shipley Mach. Tool Co. 14, 15
New Britain Machine Co..... 84
Niles-Bement-Pond Co....2, 3, 46
Potter & Johnston.....20, 21
Pratt & Whitney Co..... 47
Prentice Bros. Co..... 29
Springfield Mach. Tool Co.... 49
Warner & Swasey Co..... 39
Windsor Machine Co..... 45

Turret Machines, Vertical
Bullard Machine Tool Co..70, 71
Flather Mfg. Co., E. J.....105
Niles-Bement-Pond Co....2, 3, 46

Turrets, Carriage
Blount Co., J. G.....119

Twist Drills
Boker & Co., Hermann..... 77
Celfor Tool Co..... 98
Cleveland Twist Drill Co.....136
Detroit Twist Drill Co..... 97
Hammacher Schlemmer & Co. 65
Lincoln-Williams Twist Drill Co. 99
Morse Twist Drill & Mach. Co. 59
Niles-Bement-Pond Co....2, 3, 46
Pratt & Whitney Co..... 47
Standard Tool Co..... 26
Union Twist Drill Co..... 67
Ward & Son, Edgar T.....113
Whitman & Barnes Mfg. Co.. 97
Wiley & Russell Mfg. Co.....100

Unions
Dart Mfg. Co., E. M.....100
National Tube Co.....111

Universal Joints
Baush Mach. Tool Co..... 36
Boston Gear Works.....102

Valves
National Tube Co.....111
Watson-Stillman Co..... 77

Vanadium
American Vanadium Co.....107

Vanadium Bronze
American Vanadium Co.....107

Vanadium Steel
American Vanadium Co.....107

Vise Stands
LeBlond Mach. Tool Co., R. K., 63, 136
New Britain Mach. Co..... 84
Tindel-Morris Co..... 93
Western Tool & Mfg. Co.....124

Vises, Drill
Carter & Hakes Machine Co..105
Graham Mfg. Co.....105

Vises, Hand Power
New Britain Machine Co.... 84

Vises, Metal Workers'
Athol Machine Co.....128
Brown & Sharpe Mfg. Co..55, 136
Carter & Hakes Machine Co..105
Graham Mfg. Co.....105
Hammacher, Schlemmer & Co. 65
LeBlond Mach. Tool Co., R. K., 63, 136
Millers Falls Co..... 93
Parker Co., Chas.....105
Reed Mfg. Co.....105
Walworth Mfg. Co..... 50
Western Tool & Mfg. Co.....124

Vises, Pipe
Athol Machine Co.....128
Bignall & Keeler Mfg. Co....127
Butterfield & Co.....100
Curtis & Curtis Co.....109
Parker Co., Chas.....105
Reed Mfg. Co.....105
Saunders' Sons, D.....127
St. Louis Sales Co.....105
Walworth Mfg. Co..... 50
Wells & Son Co., F. E.....119
Western Tool & Mfg. Co.....124
Williams & Co., J. H..... 80

Vises, Plain
Graham Mfg. Co.....105

Vises, Planer and Shaper
American Tool Works Co..... 8
Carter & Hakes Mach. Co.....105
Cincinnati Planer Co..... 16
Hendey Machine Co..... 61
Niles-Bement-Pond Co....2, 3, 46

Vises, Universal Machine
Becker Milling Machine Co.... 23
Brown & Sharpe Mfg. Co..55, 136
Graham Mfg. Co.....105
Skinner Chuck Co..... 98

Vises, Wood Workers'
Hammacher, Schlemmer & Co. 65
Parker Co., Chas.....105
Pratt & Whitney Co..... 47

Voltmeters
Bristol Co.....136

Wash Stands and Bowls
Manufacturing Equipment and Engineering Co.....101

Washers
Barnes Co., Wallace.....128
Milton Mfg. Co..... 67

Welding
Electric Welding Products Co.110
Goodyear, Inc., Nelson.....111
International Oxygen Co.....112
Tate, Jones & Co.....114
Toledo Electric Welder Co....111

Welding Machines
International Oxygen Co.....112
Standard Welding Co.....106
Toledo Electric Welder Co....111

Welding, Oxy-Acetylene
International Oxygen Co.....112

Wire-Flattening Mills
Blake & Johnson.....120

Wire-Forming Machinery
Automatic Machine Co..... 61
Baird Machine Co., The.....121
Blake & Johnson Co.....120
Waterbury Farrel Fdry. and Mach. Co..... 50

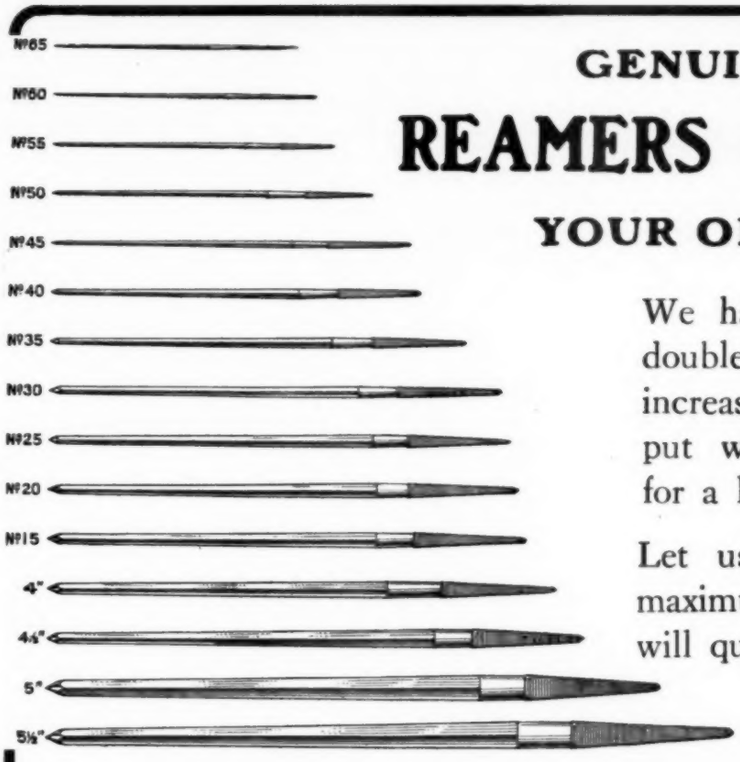
Wire, Music
Hammacher, Schlemmer & Co. 65

Wire-Nail Machinery
National Machinery Co.....126

Wire - Straightening Machinery
Adt & Son, John.....126
Hemming Bros. Co.....126
Shuster Co., F. B.....126

Wood Working Machinery
Greaves, Klusman & Co..... 86
Manning, Maxwell & Moore...129
Niles-Bement-Pond Co....2, 3, 46
Prentiss Tool & Supply Co...130
Seneca Falls Mfg. Co..... 76

Wrenches, Drop Forged
Billings & Spencer Co..... 92
Morse Twist Drill & Mach. Co. 59
Page-Storms Drop Forge Co..114
Trimont Mfg. Co..... 85
Whitman & Barnes Mfg. Co... 97
Williams & Co., J. H..... 80



GENUINE ENGLISH

REAMERS OR BROACHES

YOUR OPPORTUNITY!

We have just imported a double consignment and to increase our annual output will lower the prices for a limited time.

Let us know sizes and maximum quantity and we will quote.

(Cuts half size.)

HAMMACHER, SCHLEMMER & CO.

4th Ave. and 13th St., *HARDWARE, TOOLS AND SUPPLIES* **New York, since 1848**

It Pays US To Make Bath Grinders Pay YOU

Hence our Service Department which is at YOUR disposal.

Do you have grinding problems of any kind causing some difficulty?

Why not let us devise ways and means of economical grinding for you on Bath Grinders?

Bath Grinder Company

INC.

Fitchburg, Mass., U. S. A.

FOREIGN REPRESENTATIVES—Schuchardt & Schutte, Stockholm, Berlin, Vienna, St. Petersburg, Copenhagen, Budapest. Alfred H. Schutte, Cologne, Brusseis, Liege, Paris, Milan, Bilbao, Barcelona. Alfred Herbert, Ltd., Yokohama. Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow.

Wrenches, Machinists'
Bemis & Call Hardware & Tool Co. 92
Billings & Spencer Co..... 92
Coes Wrench Co..... 32
Hammacher, Schlemmer & Co. 65
Morse Twist Drill & Mach. Co. 59
Page-Storms Drop Forge Co..114
Trimont Mfg. Co..... 85
Whitman & Barnes Mfg. Co.. 97
Williams & Co., J. H..... 80

Wrenches, Pipe
Bemis & Call Hardware & Tool Co. 92
Billings & Spencer Co..... 92
Greene, Tweed & Co..... 96
Page-Storms Drop Forge Co..114
Reed Mfg. Co..... 105
Trimont Mfg. Co..... 85
Walworth Mfg. Co..... 50
Wells & Son Co., F. E.....119
Whitman & Barnes Mfg. Co.. 97

Wrenches, Pipe—*Continued.*
Williams & Co., J. H..... 80

Wrenches, Ratchet
Parker Co., Chas.....105
Pratt & Whitney Co..... 47
Trimont Mfg. Co..... 85

Wrenches, Tap
American Tap & Die Co..... 99

Wrenches, Tap—*Continued.*
Besly & Co., Chas. H..... 85
Billings & Spencer Co..... 92
Butterfield & Co.....100
Card Mfg. Co., S. W.....40, 41
Carpenter Tap & Die Co., J. M. 100
Smart Mfg. Co., A. J.....100
Standard Tool Co..... 26
Starrett Co., L. S..... 72
Trimont Mfg. Co..... 85
Wells Bros. Co.....100

IF you've ever been in a Union Depot, you have seen one busy spot that seems to be the Mecca of every worried-looking man, woman and child in the place.

It is prominently labeled "Bureau of Information" and rapid-fire questions by hurried travelers are speedily answered *authentically*.

The traveler saves time and research, and *gets there*.

The Classified List of Articles Advertised is another bureau of information.

As rapidly as you ask the question it tells you what's what in machinery and equipment and who's who.

And the "what" and "who" are *reliable*.

To be here is a badge of responsibility.

To buy from here is a guarantee of satisfaction.